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[1] Director. [2] Agronomist in charge. [3] Animal husbandman in charge.

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EXPERIMENT STATION RECORD.

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For some time past considerable interest has been manifested in having a list of all the projects of the experiment stations brought together in one place and published for the general information of all workers. Practically all the stations now have their work on the project basis, especially as relates to the more important features, and the idea of making these available has commended itself quite generally. There is a realization of the advantage of knowing what subjects and phases of them are being worked upon, and where, rather than being obliged to remain in the dark until the matter is disclosed through publication. Aside from the direct assistance such a record might be, it is of interest to all following the station work to see the range of activity covered and to note the showing made when the work is classified into different divisions.

During the past year the Office of Experiment Stations undertook to compile such a compendium, and collected from the various stations the titles of projects in progress in the fiscal year 1919. The undertaking was a larger one than was generally realized, as will be apparent from the fact that some thirty-seven hundred and fifty separate projects were recorded, leaving out of account those relating to administrative and regulatory matters. The titles only were supplied in most cases, and these were quite frequently general in character or failed to bring out the salient features now receiving attention.

Evidently such a list would be of comparatively little use unless classified, and from the character of the titles the task of grouping was found to present considerable difficulty. In addition to grouping under main headings, a rather minute classification was attempted in order that related projects might be brought together in a way that would make them readily found. With so large a number of separate titles this is evidently desirable, and it is hoped that the practical difficulties have been overcome to some extent by repeating the titles under the various headings to which they seem to apply, and by cross references. Familiarity with much of the work represented through examination of it at the stations aided in the effort, but despite this it is too much to expect that errors have not been made, and at best the list can only claim to be a beginning toward a better understanding of what work is under way and where different subjects are being studied.

To avoid delay the list has been issued in mimeographed form, in small edition, and will also appear in the annual report of the Office. Meantime preparation of the list of projects in progress in the fiscal year 1920 has been commenced, and it is hoped that the experience of the initial undertaking will be helpful in supplying more specific information.

In a way, the compilation of station projects illustrates the relative stress which is being laid on various departments of agricultural inquiry. By far the larger number of projects relate to crop production. There are something over a thousand agronomy topics—soils, fertilizers, and field crops, and about six hundred under the head of horticulture, while the study of diseases and insects affecting crops adds nearly seven hundred more, making a total on the general subject of crop production amounting roughly to around twenty-three hundred. The section of crop production therefore represents about three-fifths of the whole list. The largest number of titles fall under the general heading of field crops, including culture, harvesting, storage, etc., while the number under the head of soils indicates a quite remarkable development of investigation in that line as compared with earlier years.

Studies of plant diseases and insect pests have from the first constituted quite a prominent feature of station work, and the list will show that many of these projects are of quite fundamental character.

Animal husbandary, dairying and dairy farming comprise about seven hundred projects, and the diseases of animals add about one hundred and fifty more, accounting together for approximately one-fifth of the list. At first thought this is perhaps a rather surprisingly small proportion, but it may be due in part to the fact that such work is relatively more expensive as a rule than that concerned with crop production. This is true on account of the cost of the experimental material and the maintenance charges, although the experiments are often of shorter duration, especially the type of feeding experiments which constitute quite a part. The number of topics listed under the head of animal nutrition shows the growth of fundamental inquiry into the underlying principles, a line on which further advances in practical feeding must largely wait.

The list shows only about one hundred projects on topics relating to rural engineering and about seventy-five in rural economics. In both of these divisions there is believed to be opportunity for considerable profitable development of inquiry.

One result of the publication of such a project list should be to enable a closer contact between workers on similar or related topics. By showing what phases of such topics are being investigated and by whom, communication among those having common interests will be facilitated. In this way the interests of cooperation may be pro-

moted by making more evident the opportunity for it and the extent to which workers are laboring independently of one another. Earlier in the history of the stations there was more reason for such wholly independent study, as the individual stations needed to secure a certain background of fact applying to their respective conditions, and beyond this emphasis was laid by many on individualistic effort.

The war has stimulated cooperation among scientific workers in all lines and brought out its advantages, and among experiment station workers especially there is a decided interest in associative action and cooperative planning to make results more readily comparable or more comprehensive in the case of complex questions. The problems in agriculture are often many-sided and are being attacked from various standpoints, but information as to where such work is going on, it is urged, would encourage conferences of investigators on special topics and enable steps to be taken toward cooperation, coordination, or a division of the topic so that the investigation might progress more symmetrically and with better general understanding.

Such information will also largely remove the excuse for duplication or repetition of a kind which is unnecessary and not justified by the status of experimentation. Naturally there will continue to be considerable working in the same general field, often repetition in the sense of going over ground which others have traversed, but this can be done with more definite reference to the work of others and therefore be more specific in its purpose.

Furthermore, such a catalogue of station activities ought to help to emphasize, what has often been urged, the importance of making projects definite and specific and of limited range. There is little call at this stage for broad, general topics of investigation which lack clarity of aim and are not specific either as to what is being sought or how it is to be determined. There are still some lines of work—they could hardly be called projects—of that character, although not as many as the character of the titles would indicate. They need to be restated, and to do so would not merely serve to give them better form but would revive the interest of the leaders in them. The winter season is a good time for this.

A critical review of the projects under way might well result in reducing their number, especially until materially increased funds are available. The list is far too long in case of many stations. The average is nearly sixty-five for each institution, which is manifestly more than can usually be carried to advantage. Not infrequently workers are conducting more projects than they can follow adequately and give the necessary study to. In such cases the terms investigation, experiment, or observation can doubtfully be applied to the work in its present stage, for all of these terms imply study and inquiry, whereas the routine carrying through of a plan started

several years ago is at best a recording and accumulation of data in the hope of being able to study it later, but without profiting by what the results are indicating from year to year or from stage to stage.

Inferentially, the publication of such a working list will show not only where stress is now being laid but directions in which investigation is relatively weak or deficient. While the character of an undertaking can not be fully judged by the project title, the various classes will give a general indication of the amount of investigation of advanced grade and will often show the importance of materially increasing it in order that substantial progress may continue to be made. There are some subjects on which relatively little original research is now in progress, as the stations fully realize, and this situation is an indication of the need for growth.

The list is therefore not alone a catalogue of what is under way but an evidence of what needs to be done to strengthen the research efforts of the American stations. New subjects as yet hardly touched by the stations are being presented to them for serious attention. In other lines the problems have come to be of more difficult character, taxing research ability to the utmost. The doing of many of the simpler and relatively easy things has altered the demand and has also prepared the way for other efforts. The background which has resulted from over thirty years of experimental work is a great asset and a great source of strength in solving more intricate problems which could not be approached a few years ago.

Thus the scene changes and the field of inquiry advances. Man learns by doing, and grows with his work. It is the life of research, and the inspiration of every department and every virile worker.

The attention of readers of the *Record* is also directed to another mimeographed publication of much interest, entitled A Bibliography of Investigations Bearing on the Composition and Nutritive Value of Corn and Corn Products. This bibliography was prepared by Miss M. Helen Keith, first assistant in animal nutrition in the Illinois Experiment Station, and has recently been issued by the National Research Council.

The bibliography was prepared primarily as an aid to investigators and research students in the nutritional side of the corn-feeding question. The chief sources of references were *Chemical Abstracts* and *Experiment Station Record*, supplemented by citations from a few other journals. It is believed that the lists given are fairly complete so far as the results of investigational work have been published in available form.

The bibliography is arranged in three sections. The first of these consists of an author bibliography, with complete references, chrono-

logically arranged, to the original articles and abstracts thereof. In the second section, these references have been classified rather minutely by subjects, with brief notations to aid in their location under Section 1. The final section consists of a list of books or articles of too general a nature to be itemized in Section 2 and of compilations or discussions of data from several sources.

As a whole, the bibliography occupies nearly two hundred pages of manuscript size and contains over twelve hundred separate entries. This illustrates the large amount of attention which has been given to this subject by investigators, as well as the magnitude of the task of compilation. It should prove of very great service, both directly and as a stimulus for similar compilations in other fields. In arranging for its publication the National Research Council has performed a notable service.

The important place which the respiration apparatus and the respiration calorimeter have played in developing underlying principles in animal nutrition through studies of metabolism is familiar to all students of the subject. The expensive character of such apparatus, and especially of the modern type equipped to measure the output of heat, carbon dioxid, marsh gas, and water vapor, taken in connection with the complicated nature of its use, has closely limited the employment of this means of study with the larger farm animals. As a matter of fact the respiration calorimeter constructed by Dr. Armsby at the Institute of Animal Nutrition and by Dr. Hagemann at Bonn are said to be the only two examples of apparatus of this type designed for studies with large animals.

Some time ago Dr. F. G. Benedict of the Nutrition Laboratory of the Carnegie Institution of Washington found that the energy metabolism of human subjects could be estimated from a knowledge of their carbon dioxid production in a suitable respiration chamber. At his suggestion, Dr. Armsby and his coworkers examined their records from this point of view, and in a paper noted elsewhere in this issue they report that the heat elimination of cattle is a simple and easily computed function of the carbon dioxid excreted and the amount of feed consumed. This result permits the collection of energy data by means of a much simpler type of apparatus, designed mainly to measure the carbon dioxid, and thus makes possible a simplification of metabolism experiments.

Anticipating Dr. Armsby's conclusions somewhat, the nutrition laboratory constructed a large respiration chamber in which from ten to twenty-five human subjects could be studied at a time, and the experience with this suggested that the same type of apparatus might be employed in studying the metabolism of large domestic animals. Accordingly, the Carnegie Institution, through Dr. Benedict's laboratory, entered into collaboration with the New Hampshire

Experiment Station for the purpose of extending its investigations to farm animals, and a respiration apparatus was constructed at the station in the fall of 1918.

The case affords an interesting example of cooperation which has proved profitable and advantageous to both parties—the one seeking to extend the range of its inquiry while taking advantage of certain skill and facilities presented elsewhere, and the other embracing the opportunity to participate in an advanced line of study which it could otherwise not take up. This joining of interests furnishes a fine example of the cooperative spirit in action. The generosity and liberality of the nutrition laboratory has been a noteworthy feature of the enterprise, and the interest and support given by Director Kendall in the face of extreme stringency of funds shows the recognition of a rare opportunity and commendable determination to shape means to meet it.

The result has been the devising of means for studying basal metabolism in farm animals so relatively simple and inexpensive as to be within the reach of an ordinary experiment station. The apparatus built at the New Hampshire Station has lately been described in detail by Dr. Benedict and his associates, in a technical bulletin of the station noted elsewhere.

This apparatus is of the open circuit or Pettenkofer type, and is set up in the cattle barn. It consists of two main parts, the respiration chamber itself, and the ventilating appliances which provide for the entrance and removal of the air and the determination of the carbon dioxid produced by the animal. As the latter is the main object, the chamber must be air-tight and of sufficient size to accommodate a steer or several calves comfortably. In the past the building of such a chamber to guard against leakage has been one of the expensive features. It is the simplified form of this chamber that constitutes the novel character and cheapness of its construction.

The chamber is constructed of galvanized sheet iron over a rigid wooden framework, the seams of the metal jacket being locked and soldered to make them air-tight. The rear end of the compartment is removable to permit the entrance of the subject, and consists of two separate panels having an air space between them when in place of about three inches. The inner panel is held in place by wooden pegs, no attempt at a close joint being made, and the outer one is pressed tightly against the ends of the chamber by means of cross-bars and wedges. To prevent the outward leakage through the cracks at the edges of this double door, a slight positive air pressure is maintained in the space between the panels by means of a blower. As long as the pressure in this space is greater than that either outside or within the chamber there can naturally be no flow

from the inside of the chamber outward, or in the other direction except through the intake pipe. The intake is placed outdoors and leads through an opening in the exterior panel into the intervening space, from which it seeps into the chamber through the loosely fitting inner panel.

The chamber is therefore supplied with outdoor air uncontaminated by the air of the stable. The arrangement for preventing leakage at the door avoids the necessity of hermetically sealing the entrance, a process which would have to be repeated every time an experiment was made. An electric fan placed at the rear end of the chamber keeps the air in circulation so that the outlet may be placed at almost any point provided it is not too near the door.

The air is withdrawn from the chamber near the floor by means of an electric blower or ventilating device, into a wind chest from which a sample usually representing ten per cent is removed to a sampling can for measurement and for determining the carbon dioxid, the remainder of the air being allowed to escape. Sampling is necessary because of the difficulty of analyzing the total air withdrawn. The sampling can is covered with a rubber cap and, by an ingenious scheme, the slight fluctuations in the height of the cap are utilized to control the suction pump removing air from the can. Atmospheric pressure is thus maintained within—a necessary condition for securing an accurate aliquot from the wind chest.

Another interesting feature is the provision installed within the chamber for recording the muscular activity of the animal. The importance of knowing the degree of activity or repose of the subject in comparable measurements of metabolism is being increasingly recognized by investigators. To this end, a relatively simple device is employed which is based on the fact that practically any movement of the body results in a change in the center of gravity sufficient to alter materially the proportion of weight resting on the front and hind legs of the animal. The front legs of the animal rest on a movable platform supported by chains and springs and connected with a pneumograph in such a manner that any alteration in the center of gravity of the animal, and therefore any important muscular activity, is recorded graphically on the revolving drum of an inexpensive kymograph.

There are of course many ingenious devices employed in the construction of the apparatus which facilitate its regular and proper action and its control, but a special effort was made to use readily available and even makeshift materials, so as to keep the cost at the lowest level. In the form installed at the New Hampshire Station it is estimated that the chamber could be built without equipment for about $150. Moreover, the operation of the apparatus is so simple that not more than two attendants are required. The

usual duration of the experiment in the chamber is a few hours but it has been proved to be adapted to periods of twenty-four hours when necessary.

The first year in which the apparatus was used a study was carried out with twelve steers on different planes of nutrition for a continuous period of eleven months. The steers were afterwards slaughtered and examined by experts as to the effect of the nutrition on the carcasses. During the second year an experiment was carried on with two steers along similar lines except that a continuous nitrogen balance was made in connection with the respiration experiments. During the present year approximately eighty sheep of different ages are being used to determine the metabolism during various stages of growth and pregnancy. Incidentally some tests have been made with calves, and the adaptability of the chamber to group metabolism studies of pigs will also be determined.

The Nutrition Laboratory of the Carnegie Institution has continued its very helpful cooperation in conducting the investigations mentioned, the work locally being in charge of Prof. E. G. Ritzman. The partnership has enabled the New Hampshire Station to develop a new line of research in its working program at relatively small outlay and brought it into the field of advanced study in animal nutrition. The result is most gratifying and the cooperation is working out to the mutual satisfaction of both parties.

While the apparatus does not give the same degree of scientific returns as the elaborate analysis of metabolic processes made possible by the respiration calorimeter at the Institute of Animal Nutrition, nevertheless the relatively small cost of installation and the comparatively slight expense of operation will make possible the accumulation of a considerable amount of valuable data at present prevented by prohibitive costs. The simplified form is therefore a notable addition to the facilities for studies in animal nutrition, and is capable of being used in a great variety of ways. Digestion experiments may be coupled with the respiration experiments in the apparatus, and the records supplemented by growth measurements, photographs, etc. With slight modification in design the apparatus may be used to determine the carbon dioxid output of an animal undergoing a nitrogen balance experiment, in which case it is possible to estimate the protein storage from the nitrogen balance, the fat storage from the carbon balance, and the energy utilized from the relationship already indicated.

It is thus possible to make quite complete metabolism studies with comparatively humble apparatus wherever competent investigators are available to carry them out. It seems not unlikely, therefore, that this simplified apparatus may serve to stimulate investigation and have a profound influence on the progress of nutrition inquiry.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Official and tentative methods of analysis of the Association of Official Agricultural Chemists (*Washington, D. C.: Assoc. Off. Agr. Chemists, 1920, pp. XII+417, figs. 18*).—This volume, which supersedes Bulletin 107, U. S. Department of Agriculture (E. S. R., 20, p. 512) and preliminary revisions since published in the *Journal* of the association, consists of a revision of the Official and tentative methods of analysis adopted by the association up to November 1, 1919. The preface by C. L. Alsberg, the secretary, and an introduction by H. W. Wiley, honorary president of the association, are followed by chapters dealing with the technique of the Official and tentative methods for the analysis of fertilizers, inorganic plant constituents, waters, tanning materials, leathers, insecticides and fungicides, foods and feeding stuffs, saccharin products, food preservatives, coloring matters in foods, metals in foods, fruits and fruit products, canned vegetables, cereal foods, wines, distilled liquors, beers, vinegars, flavoring extracts, meat and meat products, dairy products, fats and oils, spices and other condiments, cacao products, coffees, teas, baking powders and baking chemicals, drugs, and soils, with a final chapter of reference tables.

A valuable feature of the book is the scheme of numbering the sections of each chapter in Roman numerals and the methods under each section in Arabic, thus simplifying the system of cross references. Illustrations are included of the more important types of apparatus employed.

Some American-made chemical reagents, W. D. Collins (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 800, 801*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, consists of brief notes on the examination of three American-made reagents, with recommendations as follows:

I. *Potassium ferricyanid.*—It is recommended that potassium ferricyanid which will not make a 10 per cent solution without any precipitate or green color should not be accepted, but that purification by recrystallization of poor material in stock is worth while in most cases.

II. *Methyl orange.*—The author, with the collaboration of G. C. Spencer, has made a comparison of six samples of methyl orange for odor, water-insoluble residue, and indicator value. The recommendation is made that purchasers specify methyl orange of a grade to be used as an indicator, and also stipulate that the insoluble residue from 1 gm. dissolved in 400 cc. of water shall not exceed 0.025 gm.

III. *Sulphuric acid free from nitrate: the diphenylamin test for nitrates.*—In cooperation with J. K. Morton the author examined a number of commercial samples of sulphuric acid for absence of nitrate as determined by the diphenylamin test. The results indicate that sulphuric acid can be secured which will be suitable for preparing the diphenylamin reagent, but that this grade must be specified clearly and purchased subject to examination. The most delicate

test for the presence of nitrates is thought to be the preparation of the diphenylamin reagent according to Tillmans (E. S. R., 25, p. 14) by dissolving 0.017 gm. of diphenylamin in 100 cc. of concentrated sulphuric acid (sp. gr. 1.84) and adding 30 cc. of water. Acid containing 0.000008 per cent N_2O_5 shows a decided faint blue color in 2 hours after preparing the reagent.

An apparatus for the extraction of liquids, K. Brauer and E. W. Ebert (*Chem. Ztg., 44 (1920), No. 31, p. 214, fig. 1*).—By the introduction of a stopcock at the base of an extraction device similar to the Soxhlet form, a convenient arrangement is secured for separating the solvent from the extracted liquid after the extraction is complete. The particular form of apparatus described is protected by patent.

Fractionating flask for the distillation of foaming liquids, E. Lenk (*Chem. Ztg., 44 (1920), No. 52, p. 330, fig. 1*).—The flask, which is designed for vacuum distillation, consists of an ordinary distilling flask to which a return condenser is fused below the side arm. By means of a 3-way stopcock the vacuum is connected with the condenser until the foaming ceases, after which the connection is made with the receiver joined to the side tube.

A simple device for preventing overtitration, R. Orthner (*Chem. Ztg., 44 (1920), No. 44, pp. 282, 283, fig. 1*).—The device consists of a glass tube of 5 mm. inside diameter, drawn out at the bottom to a fine opening. The tube, which extends to the bottom of the beaker, is kept in a vertical position against the side by a hook-shaped piece of glass fused into the tube on a level with the top of the beaker. In use a rapid titration is made until the indicator changes color, when the tube is raised, washed, and the titration finished.

Some improvements on the needle type thermocouple for low temperature work, G. F. Taylor (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 797, 798, fig. 1*).

Cellulose phthalate: Its preparation and properties, H. A. Levey (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 743, 744*).

A synthesis of thymol from p-cymene, M. Phillips and H. D. Gibbs (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 733, 734*).

The determination of sulphate in sulfonated oils, E. J. Kern (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, p. 785*).—For the determination of uncombined sulphate in any ordinary oil the author recommends the following procedure:

"Weigh from 20 to 40 gm. of oil into a separatory funnel, add 100 cc. of a 10 per cent solution of monosodium phosphate, shake, allow the oil and solution to separate, draw off the major portion of solution and filter free from any oil particles, acidify 50 cc. of the filtrate, and precipitate the sulphate with barium chlorid. In calculating the percentage of free sulphate in the original oil, make allowance for the dilution of the solution by the water of the oil."

A new method for the determination of phenol in the presence of certain other phenols, R. M. Chapin (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 771–775*).—A colorimetric method for the determination of phenol in the presence of other phenols, both monohydric and polyhydric, is described, by means of which it is said to be possible to determine as small an amount as 0.04 mg. of phenol in the presence of 4 mg. of cresol in a volume of 4 cc. The method is based upon the observation that on heating in a boiling water bath a mixture of the phenol and carefully prepared Millon's reagent, the red color yielded by phenol became much intensified and nearly permanent, while the red colors given by the cresols soon changed to various shades of yellow. The preparation of Millon's reagent and three possible methods of quantitative measurement are described in detail.

The behavior of phenolphthalein with iodin and a method for the determination of phenolphthalein, S. PALKIN (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 766–769*).—An investigation at the Bureau of Chemistry, U. S. Department of Agriculture, of the behavior of phenolphthalein with iodin has led to the development of a method for the accurate quantitative determination of phenolphthalein, especially in medicinal preparations.

"This method is based on the quantitative yield of tetraiodophenolphthalein when a solution containing phenolphthalein and iodin is alternately made alkaline to complete solution and acid to complete precipitation, at a low temperature. The tetraiodophenolphthalein is determined by extraction with acetone-chloroform mixture, applying the usual method of immiscible solvents."

The technique of the method is described in detail, and the results are given of its application to a number of medicinal preparations.

A new method for the estimation of methyl alcohol, S. B. SCHRYVER and C. C. WOOD (*Analyst, 45 (1920), No. 530, pp. 164–170*).—Methods for the quantitative estimation of very small amounts of methyl alcohol when present in water, in acetone, and in alcohol are described in detail. The method in the first two cases consists essentially in determining the concentration of ammonium persulphate necessary to destroy completely the formaldehyde formed in the initial stages of the oxidation. The formaldehyde is detected by the brilliant red color produced in the presence of phenylhydrazin hydrochlorid, potassium ferricyanid and concentrated hydrochloric acid, according to the technique described by Schryver (E. S. R., 23, p. 116).

For determining the amount of methyl alcohol in ethyl alcohol, the mixture of alcohols is partially oxidized by a relatively small amount of persulphate and the color produced in the formaldehye test compared with that produced in standard mixtures of ethyl and methyl alcohol.

Rapid determination of small amounts of copper by the iodid method, H. F. BRADLEY (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, p. 800*).—In the method described the precipitate of cupric sulphid is washed free from chlorids, moistened with a few drops of strong neutral zinc nitrate solution, and ignited. The residue of zinc and cupric oxids is quickly dissolved by warming with 1 cc. of 1:2 HCl, neutralized with 5 per cent KOH, and acidified with acetic acid. After adding a little phosphate solution to prevent the action of iron, 2.5 gm. of solid sodium iodid is added and the solution titrated as usual.

The electrometric analysis of arsenicals, C. S. ROBINSON and O. B. WINTER (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 775–778, figs. 4*).—The authors, at the Michigan Experiment Station, describe an electrometric titration method for the determination of trivalent arsenic even in colored solutions, and which is also applicable to the direct titration of pentavalent arsenic.

[Bacteriological examination of tomato products], E. BERTARELLI and M. MARCHELLI (*Ann. Ig. [Rome], 30 (1920), No. 6, pp. 309–322*).—The authors discuss the relative merits of the Howard method (E. S. R., 24, p. 613) and the direct-count method as described by Vincent (E. S. R., 39, p. 13) for the examination of tomato products for content of bacteria, molds, etc. While the Vincent method is considered superior to the Howard, the possibility of errors in both are thought to be considerable. As a substitute method a procedure is recommended which is essentially as follows:

Two cc. of the tomato product is made up to 50 cc. with distilled water, shaken thoroughly, and filtered through four thicknesses of muslin. The residue is carefully washed with another 50 cc. portion of distilled water and the filtrate collected in the beaker containing the original filtrate. The combined filtrate is estimated to contain all but about 20 per cent of the bacteria originally

present, and in estimating the bacterial count a correction is made for this. By careful manipulation $\frac{1}{250}$ cc. portions are dropped from a pipette on glass slides, spread over the surface with a platinum wire, fixed with alcohol-ether, stained with Loeffler's blue, and subjected to microscopic count in the usual way.

With the use of this method a number of samples of Italian tomato products were examined and compared with the United States standards for bacterial count. A study was also made of the effect on the content of bacteria and molds of different temperatures during the preparation of the product and of length of storage. The data obtained in this study indicate that, as far as bacteria are concerned, it is not necessary to sterilize the product completely. Mold growth, however, was quite extensive in the products which had not been completely sterilized. For this reason the use of sound, thoroughly washed tomatoes is urged.

Modification of the Howard method for counting yeasts, spores, and bacteria in tomato products, H. M. Miller (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 766–769*).—The modification described consists in a preliminary heating of the material (20 cc. of tomato juice or 5 cc. of paste diluted to 30 cc.) successively with from 2 to 4 cc. of Loeffler's alkaline methylene blue and 2 cc. of Ziehl-Neilsen's carbofuchsin. After reducing any excess of carbofuchsin with from 5 to 10 drops of formaldehyde the material is diluted with water to 60 or 120 cc. and shaken well and is then used in preparing the slides for examination by the usual Howard method. Artificial light should be used for the examination of the slides.

A volumetric method for the detection and estimation of neutralizers in butter and in certain allied products, L. W. Ferris (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 757–760, fig. 1*).—A method has been devised at the Bureau of Chemistry, U. S. Department of Agriculture, for detecting and estimating neutralizers in butter and allied products. The method as applied to butter is as follows:

To the residue from 100 gm. of butter from which the fat has been removed by shaking out with gasoline and centrifuging, 50 cc. of N/10 HCl and 100 cc of a saturated solution of picric acid are added. After shaking constantly for one-half hour in a closely stoppered flask, the mixture is cooled and filtered on a dry paper, and a 50 cc. aliquot of the filtrate is extracted with ethyl ether in a liquid extraction apparatus for 20 hours, transferred to a 200 cc. Erlenmeyer flask provided with a trap to condense the vapors formed on boiling, and boiled gently to expel CO_2. The solution is then cooled and titrated with N/10 NaOH, using methyl orange or butter yellow as indicator. Under these conditions the excess of HCl added over the amount neutralized by the KOH is a measure of the alkalinity of the salts or the amount that has been combined with the bases formerly present as alkalis, lactates, and phosphates. The alkalinity in cubic centimeters, divided by the amount of P_2O_5 in milligrams in the same aliquot, and multiplied by 100, will give the alkalinity ratio.

For cream, milk, or buttermilk the procedure is the same except that a smaller sample is used and the preliminary removal of the fat is unnecessary. For milk, buttermilk, or thin cream a 15 gm. sample is recommended, for thick cream 25 gm., for evaporated milk 7 gm., and for dried milk 1 gm.

Determinations on butters made from fresh raw cream, from rancid and sour creams, and from cream to which varying amounts of neutralizers had been added are reported. These indicate that the alkalinity ratio varies little, if any, in fresh raw cream from that in rancid and very sour creams that have not been neutralized. In butters made from creams to which neutralizers were added the alkalinity ratio was always higher than when no neutralizer was used, and showed wide variations according to the amount of neutralizer added.

For calculating the percentage of acidity neutralized in a sample of cream or milk when the phosphoric acid content of the cream from which the butter is made is known, the following formula is given: $A=\frac{P(R-45)}{11.11}$, where A=percentage of lactic acid reduced, P=percentage of P_2O_5 in cream or milk, and R=alkalinity ratio of the sample. If the P_2O_5 content of the cream is not known an average figure must be taken, and only an approximation of the amount of acid neutralized in the cream can be made.

The methods is described in detail, and tables are given and discussed of the results with 25 samples of unneutralized cream, 7 samples of neutralized cream, and 28 samples of butter from neutralized cream.

A preliminary report on the study of the temperatures at which milk of different percentages of acidity will coagulate, T. J. McInerney (*Jour. Dairy Sci., 3 (1920), No. 3, pp. 220-226, fig. 1*).—The relation between acidity, temperature, and coagulation of milk was studied by adding varying amounts of N/10 lactic acid to 100 cc. portions of milk, the acidity of which had been determined by heating a sample with N/10 alkali using phenolphthalein as an indicator, titrating in a steam bath until coagulation occurred, and noting the temperature of coagulation.

The tabulated results of tests with over 200 samples of milk indicate that milk containing 0.57 per cent of acid (in terms of lactic acid) will precipitate at temperatures between 60 and 65° F., milk containing 0.5 per cent acid at 75 to 80°, 0.4 per cent at 100 to 110°, and 0.35 per cent at about 150°, while that containing 0.25 per cent acid will not coagulate until heated to 180°.

Attention is called to the great range of temperature between the coagulation for the 0.4 and 0.35 per cent acidities. In explanation of this the suggestion is made that at about 100° a chemical change takes place in the calcium salts of the milk which prevents the precipitation of the casein. The fact that the addition of disodium phosphate retards the precipitation of the curd in milk, while monocalcium phosphate hastens the coagulation, is thought to afford support to this suggestion.

The Kreis reaction of cottonseed oil products, W. B. Smith (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 764-766, fig. 1*).—From selected observations covering a period of 11 years' experience with the use of the Kreis test for rancidity, the author presents evidence that not only crude but also refined cottonseed oils may give the reaction.

In order to decide whether a positive Kreis test always indicates rancidity, experiments with various commercial fats and oils were conducted on the assumption that an increase in the Kreis test after exposure of a sample of oil to direct sunlight would indicate rancidity while a decrease would indicate natural chromogenetic substances. The assumption was proved correct by tests with crude oils known to contain natural chromogenetic substances, and was later tested with a number of commercial samples of fats and oils. The results obtained confirmed the conclusions of Kerr previously noted (E. S. R., 39, p. 313), with the exception that samples of nonrancid, purified cottonseed oil responded to the test. The author concludes that the Kreis test is not entirely dependable for the detection of rancidity in cottonseed oil.

The testing of saccharimeters by means of the telescopic control tube, C. A. Browne (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 792-796, figs. 4*).—This is a description of the use of the telescopic control tube for determining the errors of saccharimeter scales and comparing the scales of different saccharimeters, the comparative accuracy of reading different saccharimeters, the probable error of readers of the saccharimeter, and the influence of the personal equation.

The clarification of cane juice without chemical treatment, F. W. Zerban (*Louisiana Stas. Bul. 173 (1920), pp. 26, figs. 2; also in La. Planter, 65 (1920), Nos. 13, pp. 204–206; 14, pp. 220–222, figs. 2*).—The investigations discussed in this bulletin form a continuation of the work described in Bulletins 161 (E. S. R., 39, p. 113) and 165 (E. S. R., 41, p. 208) from this station.

The author reviews briefly the methods at present employed in the clarification of cane sugar, and points out that in all of these methods the mechanical effect is more important than the chemical reactions involved. The true nature of this mechanical effect is thought to be essentially the adsorption of colloidal particles of the unclarified juice by means of the filtering medium or clarifying agents. In ordinary filtration this is accomplished to a certain extent. If the juice is heated before filtration the colloids form larger aggregates which, however, being nonrigid soon clog the pores of the filtering medium. If lime is used in addition to heat, the insoluble lime salts adsorb the colloids in proportion to their active surface. In the sulfitation process a much larger quantity of finely divided precipitate is produced and in the carbonation process still more with increased adsorption. On the ground that, if the adsorption theory is correct, it should be possible effectually to clarify cane juices by simply introducing into them chemically inert substances of high adsorbing power, an investigation of chemically inert substances as filtration aids was undertaken, the results of this study forming the body of the present report.

The possibilities of Kieselguhr and decolorizing carbons, singly and combined, for clarifying cane juices were tested both on a laboratory and factory scale, using Filter-Cel, a specially prepared form of Kieselguhr, and Norit, a highly active decolorizing carbon. The analyses of sugars obtained after treatment of the raw juice with 0.25, 0.5, and 1 per cent of Filter-Cel alone and followed by 1 per cent of Norit showed that with 0.25 per cent of Filter-Cel alone a purity increase of 0.4, with 0.5 per cent one of 0.42, and with 1 per cent one of 0.49 was obtained. The additional increase in purity due to the use of 1 per cent of Norit averaged 0.5. There was no increase in the glucose ratio and, therefore, no inversion with either Filter-Cel or Norit. The ash was reduced considerably by the Filter-Cel but not any further by the Norit, probably owing to the fact that the Norit had not been treated with acid and, therefore, contained about 4 per cent of soluble ash. The largest reduction by both Filter-Cel and Norit was in the organic nonsugars, the Norit, however, removing material such as free acids and coloring matter which is not affected by the Filter-Cel. The results as a whole indicated that the preliminary treatment with Filter-Cel greatly facilitates the work of the Norit.

Large scale factory tests not only corroborated these conclusions, but also showed that the combination process effectively sterilized the juice. Determinations of the iron and polyphenol compounds in the factory runs showed a decided reduction over the results usually obtained in the sulfitation process. It is emphasized, moreover, that in the latter process the colors are only bleached temporarily, while in the new process they are actually removed. In regard to the yield of sugar in comparison with the sulfitation process, it was found that at least the same quantity of first sugar of greatly superior quality can be made with 0.5 per cent Filter-Cel followed by 1 per cent Norit, filtering the juice in both cases. The first molasses is so very light in color that it is thought possible to increase materially the recovery of high grade sugar while still leaving a molasses of higher market value than that made by the usual plantation methods.

The relative importance of some coloring matters in cane juices and sirups, F. W. Zerban (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 744–751*).—The author reviews briefly the results of investigations previously carried out at the Louisiana Sugar Experiment Station on the color of sugar-

cane products, and reports the results thus far obtained in an extensive investigation of the exact nature and proportions of the various factors contributing to the color. The problem was approached from the synthetic side, the investigation consisting of the preparation of artificial products in which the different coloring matters were added by themselves and in combination, and their effect on the color of the products determined. The present article deals with the effect of two groups of coloring matters, the decomposition products of sugars by heat in the presence and absence of other impurities and the iron-greening, water-soluble tannin of the cane.

Five series of artificial raw juices were prepared as follows:

(1) A 12 per cent sucrose solution to which enough aconitic acid was added to bring the phenolphthalein acidity to 0.015 N, the average acidity of Louisiana cane juice; (2) juice of the same composition to which was added 2.1 per cent of invert sugar; (3) juice to which was further added 0.067 per cent of asparagin exactly neutralized with KOH; (4) juice to which was added 0.133 per cent of aspartic acid, also neutralized by KOH; and (5) juice to which was added a quantity of iron-greening tannin corresponding to 0.0167 per cent of gallotannic acid. Each of these raw juices was clarified by five different methods based on those in actual factory practice, and part of the clarified juice was evaporated to sirup. All of the runs were repeated after adding to the raw juice 0.002 per cent of iron in the form of ferric chlorid. The regular sugarhouse analysis was made on every product, and in each case the total depth of color was measured by the Hess-Ives tint-photometer, standardized as previously noted (E. S. R., 41, p. 208).

From the results obtained, which are discussed in detail, the conclusion is drawn that in the methods of clarification generally practiced in Louisiana the dark color found in the factory products is almost entirely due to several polyphenol derivatives, principally the iron-greening tannin occurring in the cane juice. In the presence of ferric salts the color is from two to three times as dark as with the polyphenols alone. It is pointed out that the methods of clarification at present employed in Louisiana do not effectively remove these colloidal substances, and that the solution of the problem of cane juice purification must be sought in the field of colloid chemistry.

Chemical control in the beet sugar industry, S. J. Osborn (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 803-805, fig. 1*).—This paper outlines the essential activities of the chemical department of a large beet sugar factory.

Sugar beet and apple sirups, L. E. Longley (*Idaho Sta. Circ. 14 (1920), pp. 7, figs. 4*).—Brief directions are given for the home manufacture of apple and sugar beet sirups. Directions for the latter include those recommended by Townsend and Gore (E. S. R., 37, p. 511) and a recent modification of this method as described by Ort and Withrow (E. S. R., 42, p. 507).

The author has still further modified this method by using a cider mill to grind the beets after topping and washing. The mill is adjusted so as to grind the pulp more coarsely than in grinding apples for cider. The resulting pulp is boiled with a little water, the liquid strained from the pulp through cheesecloth, and the pulp subjected to a second extraction.

The apple sirup is recommended particularly for the making of jams and sweet pickle, and the beet sugar sirup for sweetening dark colored cakes and cookies and for candy making.

Report of the chemical division, M. O. Johnson and K. A. Ching (*Hawaii Sta. Rpt. 1919, pp. 40-42*).—Satisfactory results on a semicommercial scale have been obtained in the drying of Hawaiian food products by the use of a large tower drier holding trays 3 ft. wide by 4 ft. long. A blower driven by a small gasoline engine forces air around steam coils and up through the trays in the

tower. Data are given on the extent of removal of moisture from various vegetables and fruits by this method.

Avocado and papaya fruit have been preserved by placing the peeled fruit cut in small cubes in sterilized jars and filling the jars with an ordinary commercial tomato cocktail sauce heated to boiling.

It has been found possible to utilize pineapple juice in the preparation of jelly and of vinegar. For the former, equal parts of clarified pineapple juice and guava extract are used, or pectin precipitated from guava extract by alcohol is added to the pineapple juice before boiling down. The juice can be concentrated by freezing and separating by centrifugal action. In preparing vinegar from pineapple juice, the juice testing 11° Brix was sterilized, cooled, and inoculated with ordinary yeast. After standing 5 days samples showed an alcoholic content of 5 per cent. The clear juice was then decanted and mixed with a fairly active cider vinegar in the proportions of 1 part of vinegar to 4 or 8 parts of the juice. When tested 2½ months later the 1 : 4 mixture contained 4.2 per cent of acetic acid and proved to be a vinegar of fine quality.

The action of ultraviolet light on the yeastlike fungi, I. B. Feuer and F. W. Tanner (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 740, 741, figs. 2*).—On exposure of water suspensions of cultures of yeasts and yeastlike fungi to ultraviolet light from a quartz mercury vapor lamp operating on 110 volts at a distance of 25 cm., 23 out of 30 organisms were killed within 1 minute, two survived 1 minute, one 3 minutes, one 4 minutes, two 7 minutes, and one 10 minutes. The possibility is suggested of using ultraviolet light in controlling the development of yeast cells in the industries.

Progress in tobacco studies during 1915–1919, R. Kissling (*Chem. Ztg., 44 (1920), No. 42, pp. 265–267*).—This is a survey of the literature on tobacco chemistry, culture, and manufacture, the nicotin content of tobacco, and tobacco substitutes. A list of 99 literature references is included.

METEOROLOGY.

Composition of the atmosphere, A. Krogh (*K. Danske Vidensk. Selsk. [Math. Fys. Meddel.], 1 (1919), No. 12, pp. 1–19; abs. in Sci. Abs., Sect. A—Phys., 23 (1920), No. 272, pp. 413, 414*).—An apparatus devised by the author, with which absolute determinations of CO_2, O, "N" (N+inert gases) and combustible gases may be made with an accuracy of 0.001 per cent, is briefly described.

In examinations of samples of air from various sources, it was found that the proportion of combustible gases was below 0.0005 per cent and probably less than 0.0002 per cent, much less than the commonly assumed value of 0.003 per cent. The proportion of nitrogen plus inert gases was very nearly constant, the average of the observed variations being less than 0.003 per cent. It is claimed that the average percentage of nitrogen plus inert gases in the troposphere is a geophysical constant which can be determined within 0.001 per cent. Two analyses of air gave the absolute composition at the surface of the earth as carbon dioxid 0.03 per cent, nitrogen plus inert gases 79.022 per cent, and oxygen 20.948 per cent. Street air of Copenhagen showed somewhat more carbon dioxid and less oxygen than the normal.

"The author urges a thorough study, by the methods developed, of the composition of atmospheric air, including samples from great heights. The paper is printed in English."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 7 (1920), Nos. 3, pp. [216], pls. 4, fig. 1; 4, pp. [205], pls. 4, figs. 2*).—These volumes contain brief summaries and detailed tabular

statements of climatological data for each State for March and April, 1920, respectively.

Meteorological records for 1918 (*New York State Sta. Rpt. 1918, pp. 467–478*).—Tables are given showing tridaily readings at Geneva, N. Y., of standard air thermometers for each month of the year; daily readings of maximum and minimum thermometers at 5 p. m. for each month of the year; a monthly summary of maximum, minimum, and standard thermometer readings for the year; monthly and yearly maximum and minimum temperatures from 1883 to 1918, inclusive; average monthly and yearly temperatures since 1882; and rainfall by months since 1822.

The season of 1919, L. Moomaw (*North Dakota Sta. Bul. 138 (1920), pp. 3–9*).—Observations at the Dickinson Substation, North Dakota, on precipitation for 1892–1919; evaporation, temperature, and length of growing season, 1907-1919; and wind velocity, 1908 1919, are summarized in tables.

It is noted especially that the annual and seasonal precipitation at this place during 1919 was the lowest recorded during the 28 years that records have been kept. The annual precipitation was 8.35 in., as compared with the 28-year average of 15.12 in. The seasonal precipitation, April to September, was 5.82 in., as compared with an average of 11.75 in. The season was also characterized by extremely high temperatures, being 3 to 10° F. above the average. The maximum of 108° was recorded June 28. The evaporation from a free-water surface during the growing season was 42.6 in., as compared with a 13 year average of 32.7 in. The frost-free period was 124 days, the longest recorded at this place.

Phenological observations, 1919, E. Ihne (*Arb. Landw. Kammer Hesse, No. 26 (1919), pp. 3–24*).—This is a record of observations during 1919, on the same uniform plan as in previous years, at 29 stations in Hesse, 41 in North Germany, 6 in Austria, 1 in Hungary, and 1 in the Netherlands. Observations on crop plants, as well as wild vegetation, are included.

The influence of altitude on the appearance of different phases of vegetation, W. Pfaff (*Arb. Landw. Kammer Hesse, No. 26 (1919), pp. 31–38*).—From comparative observations at Bozen-Gries and at Oberbozen, at 920 meters higher elevation, the author shows that for each 100-meter (328 ft.) increase in altitude the onset of spring and summer was delayed about 4 days and the appearance of autumn about 2½ days, but that the coloring of leaves in the late autumn was hastened about 2 days. Comparing the observations at these places with similar observations at other places in different latitude, the author concludes that, other conditions being the same, the variation in temperature due to variation in altitude has a greater effect in modifying the progress of vegetation phenomena than the same differences in temperature due to variations in latitude.

Recent phenological literature, E. Ihne (*Arb. Landw. Kammer Hesse, No. 26 (1919), pp. 24–26*).—Fifteen annotated references to literature are given.

SOILS—FERTILIZERS.

Chemical analysis of soils, B. de C. Marchand (*Union So. Africa, Dept. Agr. Jour., 1 (1920), No. 4, pp. 341–348*).—The object of this article is to indicate the limitations as well as the value of soil analysis, for the benefit of farmers.

The classification of soils according to their electrical conductivity, B. von Horváth (*Internatl. Mitt. Bodenk., 6 (1916), No. 4, pp. 230–236*).—Experiments are reported from which the conclusion is drawn that the exact classification of all soils merely according to the electrical conductivity of their water extracts is impossible.

Soil survey of Wayne County, Iowa, C. LOUNSBURY ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 24, pl. 1, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 335,360 acres in southern Iowa situated in the glacial and loessial region. The area is classed in three topographic divisions, namely, level to undulating ridges, flat stream bottoms, and the intervening areas.

The soils are of glacial, loessial, and alluvial origin. Six soil types of four series are mapped, of which the Grundy silt loam, a loessial soil, covers 46.2 per cent, and the Shelby loam, a glacial soil, covers 45.6 per cent of the area.

Soil survey of the Belvidere area, N. J., A. L. PATRICK ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 72, pls. 4, fig. 1, map 1*).—This survey, made in cooperation with the Department of Conservation and Development of New Jersey, deals with the soils of an area of 488,960 acres in the southwestern part of northern New Jersey comprising nearly all of Hunterdon County, about three-fourths of Warren County, about one-third of Mercer County, and small parts of Somerset, Morris, and Sussex Counties. The area includes mountainous ridges, broad and narrow valleys, and plain-like plateaus, and as a whole is well drained.

The soils of the area lie in seven soil provinces, namely, the glacial, glacial lake and river terrace, limestone valleys, Appalachian mountain, Piedmont plateau, coastal plain, and river flood plains provinces. They are derived either from glacial till, directly from the underlying rocks, or from water-laid deposits.

Including muck and rough stony land, 37 soil types of 22 series are mapped. The Chester series is the largest, and the Chester gravelly loam, covering 14.3 per cent of the area, is the most extensive recognized type.

The red soil problem, E. BLANCK (*Internatl. Mitt. Bodenk., 7 (1917), No. 1-2, pp. 66-89*).—Confirming his previous findings (E. S. R., 36, p. 115), the author summarizes his own investigations and reviews the opinions of others on the subject to show that the occurrence of red soils in the Mediterranean region is explained by a combination of so-called geological diffusion and metasomatic displacement with the residue theory and climatic conditions as they prevail in that region.

Further investigations on the condition of the soil crumb structure, P. EHRENBERG and J. P. VAN ZYL (*Internatl. Mitt. Bodenk., 7 (1917), No 1-2, pp. 90-103*).—Continuing previous work by Van Zyl (E. S. R., 36, p. 720), studies conducted at the University of Göttingen on the effect of preparing soil samples for sedimentation analysis by shaking with water and air-drying are reported.

It was found that shaking of soil samples with water as a preliminary to sedimentation analysis is unnecessary, as the same results were obtained without such shaking. Furthermore, it was found that the shaking should be avoided because it has a marked influence on the firmness of the cohesion of the individual soil crumbs. If some such treatment is necessary to save time the addition of ammonia is recommended. Air-drying of soil samples was found to increase the firmness of cohesion of the individual soil crumbs, so that under sedimentation analysis they separated into their constituents very slowly. This was more especially the case with the very fine soil crumbs.

The capillarity of the soil, J. VERSLUYS (*Internatl. Mitt. Bodenk., 7 (1917), No. 3-4, pp. 117-140, figs. 11*).—Theoretical and actual studies of the state in which water exists on the so-called phreatic surfaces of soil are reported. It is believed that water exists in soils in the pendular, funicular, and capillary conditions, depending on the moisture content of the soil.

The pendular condition is that existing in slightly moist soils and is likened to the condition of a heap of wetted spheres in which a pendular body of water

is held at each point of contact of the spheres. The funicular condition is that existing in more moist soils than those in pendular condition. In such a condition there is sufficient water present so that threads of water run throughout the mass. When the limiting point is reached at which the soil pores are entirely filled with moisture, the water is considered to be capillary.

The effect of the initial moisture in a soil on moisture movement, P. E. KARRAKER (*Soil Sci., 10 (1920), No. 2, pp. 143–152, fig. 1*).—In experiments conducted at the Kentucky Experiment Station soils were placed in specially devised tubes and different initial moisture conditions brought about. These tubes were set in vertical positions, with their lower ends in water and the distance of penetration of water at various times determined.

It was found that small differences in initial moisture content of the soils were for the most part without significant effect in this connection. The distance of movement was as great in the oven-dry or air-dry soil as in soil containing an additional initial small amount of water.

Soil solution, P. EHRENBERG and J. P. VAN ZYL (*Internatl. Mitt. Bodenk., 7 (1917), No. 3–4, pp. 141–175*).—Studies conducted at the University of Göttingen on soil solutions forced from loam and clay soils under high pressure to determine the action of organic fertilizers thereon by this method are reported, together with a summary of the results of the work of others bearing on the subject.

Apparently no final and definite conclusions are drawn as to the efficacy of the pressure method of studying soil solutions, although the hope is expressed that it may broaden the knowledge of soil solutions. It is pointed out, however, that in addition to the heavy equipment required the process is tiresome and long drawn out.

A proposed method for the estimation of total calcium in soils and the significance of this element in soil fertility, O. M. SHEDD (*Soil Sci., 10 (1920), No. 1, pp. 1–14*).—In a contribution from the Kentucky Experiment Station, a proposed method for estimation of total calcium in soils is described which it is thought eliminates the chief sources of error of the regular procedure.

This method has been found to give more concordant results and is more rapid. When some of the methods used in this work were tried on a synthetic soil solution a better agreement was obtained than when they were applied to soils, indicating that a synthetic solution does not always act in the same manner as a solution of the soil which it is supposed to represent.

Determinations were made of the total calcium content of a large number of Kentucky soils, both virgin and cultivated, and it was found that in nearly every instance cultivation had caused a considerable loss of this element. From an investigation including several hundred samples taken from the soils of nearly all the counties in the State, it was found that the best types of soil contained the most calcium and the poorest the least.

Plant distribution around salt marshes in relation to soil acidity, E. T. WHERRY (*Ecology, 1 (1920), No. 1, pp. 42–48*).—An account is given of a few observations made by the author to show that the acidity of the soil is closely connected with the distribution of native plants.

The oxidizing power of soil from limed and unlimed plats and its relation to other factors, J. R. NELLER (*Soil Sci., 10 (1920), No. 1, pp. 29–39, figs. 2*).—Studies conducted at the New Jersey Experiment Stations on the oxidizing, nitrifying, ammonifying, and nitrogen-fixing powers of fresh soils from the urface 6 in. of four $\frac{1}{20}$-acre fertility plats are reported.

The oxidizing power of the soil from the limed plats was approximately 40 per cent greater than that from the unlimed plats and varied inversely with its lime requirement. Nitrate accumulation and bacterial numbers were higher

on the limed soils, but the ammonia accumulation was about the same for all of the plats. The average crop yield for the past 10 years was found to vary closely with the present oxidizing power of the soils. There was a noticeable correlation between crop yield, nitrate accumulation, and bacterial numbers, but not between crop yield and ammonia accumulation.

Lime requirement of Pennsylvania soils, J. W. White (*Pennsylvania Sta. Bul. 164 (1920), pp. 36, figs. 6*).—A lime requirement survey of the soils of Pennsylvania is reported, which included a study of 1,474 samples of soil taken from 50 counties and representing all the soil series in the State of agricultural importance.

Seventy-two per cent of the soil areas tested were acid. The average lime requirement of the limed soils was found to be 1,749 lbs. of calcium carbonate per acre as compared with 3,105 lbs. where no lime had been used. The lime requirement of these soils bore a close relation to their productivity, but not to their texture.

All the soils of Potter County examined were acid, the average lime requirement for the county being 7,928 lbs. Only 3 per cent of the soils of Lehigh County examined were acid, the average lime requirement for the county being 124 lbs.

As a general average, clover failed on 49 per cent of the unlimed soils of the State, produced a medium growth on 26 per cent, and a good growth on 15 per cent. It also failed on 15 per cent of the alkaline Volusia and DeKalb soils, and on 24 per cent of the alkaline southeastern soils.

The well-drained soils of the State were less acid than those poorly drained. Eighty-five per cent of the river bottom soils were acid. In the southeastern part and throughout the limestone valleys, the unlimed soils seldom showed the need of more than 2,000 lbs. of limestone. These soils showed very little difference in their lime requirement, and a requirement of more than 3,000 lbs. was found to prevent a normal growth of clover. The soils of the State occupying the area where the average lime requirement varied from 0 to 1,000 lbs. included the section where alfalfa and clover grow to the best advantage.

The soils of southwestern Pennsylvania showed an average lime requirement of 2,622 lbs. where no lime had been used. Of this unlimed area, 84 per cent was acid. The lime requirement of the soils of 45 counties varied with the distance from the limestone valleys. The average lime requirement of the soils in the general fertilizer series at the station was 1,467 lbs. when treated with commercial fertilizers for 34 years and 1,074 for manured soils.

Information is also given on the sources of lime for agricultural use in the State.

The antagonistic action of calcium and iron salts toward other salts as measured by ammonification and nitrification, J. E. Greaves (*Soil Sci., 10 (1920), No. 2, pp. 77–102, figs. 20*).—Experiments conducted at the Utah Experiment Station on the antitoxic action of calcium and iron salts toward other compounds occurring in alkali soils are reported.

It was found that a true antagonism exists between calcium sulphate and sodium carbonate, nitrate, and sulphate, calcium and magnesium chlorids, and magnesium sulphate as measured in terms of ammonification. This was greatest with sodium carbonate and did not occur with sodium chlorid. The antagonism between calcium and magnesium, although small, also occurred as measured by nitrification. A similar antagonism was found to exist between these salts, with the exception of sodium sulphate, calcium chlorid, and calcium sulphate, as measured in terms of nitrification.

Iron salts were usually found to improve the physical nature of alkali soils, and some iron salts exerted a true antitoxic action toward some alkali salts.

This antagonism was usually greater between monovalent and bivalent ions than between two bivalent ions.

As measured in terms of ammonification, a true antagonism was found to exist between sodium sulphate *v.* iron sulphate, calcium chlorid *v.* iron sulphate, sodium chlorid *v.* iron chlorid, sodium chlorid *v.* iron sulphate, magnesium chlorid *v.* iron nitrate, sodium chlorid *v.* iron carbonate, calcium chlorid *v.* iron carbonate, calcium chlorid *v.* iron nitrate, sodium nitrate *v.* iron chlorid, calcium chlorid *v.* iron chlorid, sodium carbonate *v.* iron nitrate, sodium carbonate *v.* iron carbonate, sodium sulphate *v.* iron nitrate, sodium chlorid *v.* iron nitrate, magnesium sulphate *v.* iron nitrate, sodium carbonate *v.* iron sulphate, sodium nitrate *v.* iron nitrate, sodium nitrate *v.* iron sulphate, magnesium sulphate *v.* iron chlorid, and magnesium sulphate *v.* iron carbonate. This was small in the case of the first pair and increased in the order named until the last, which neutralized 75 per cent of the toxic effect of magnesium sulphate.

No antagonism was found to exist between sodium carbonate *v.* iron chlorid, sodium sulphate *v.* iron carbonate, sodium nitrate *v.* iron carbonate, magnesium sulphate *v.* iron sulphate, magnesium chlorid *v.* iron chlorid, magnesium chlorid *v.* iron sulphate, sodium sulphate *v.* iron chlorid, and magnesium chlorid *v.* iron carbonate.

As measured in terms of nitrification, a true antagonism was found to exist between sodium carbonate *v.* iron carbonate, sodium chlorid *v.* iron chlorid, magnesium sulphate *v.* iron nitrate, sodium carbonate *v.* iron sulphate, sodium nitrate *v.* iron sulphate, sodium sulphate *v.* iron carbonate, calcium chlorid *v.* iron carbonate, sodium nitrate *v.* iron carbonate, sodium chlorid *v.* iron nitrate, magnesium sulphate *v.* iron carbonate, sodium nitrate *v.* iron chlorid, sodium sulphate *v.* iron nitrate, sodium sulphate *v.* iron chlorid, magnesium chlorid *v.* iron carbonate, calcium chlorid *v.* iron nitrate, magnesium sulphate *v.* iron chlorid, sodium chlorid *v.* iron sulphate, magnesium chlorid *v.* iron sulphate, magnesium sulphate *v.* iron sulphate, magnesium chlorid *v.* iron chlorid, sodium carbonate *v.* iron chlorid, and magnesium chlorid *v.* iron nitrate. This was low in the case of the first pair and increased progressively in the order named up to the last named pair, in which the iron nitrate increased the nitrification 420.7 per cent over that soil treated with magnesium chlorid alone.

The quantity of iron required for maximum effect varied with the iron compound and the specific alkali. In no case, however, did the quantity exceed 186 parts per million of iron. Although the greatest influence was exerted by the cations, the anions were not without effect.

A list of 23 references to literature bearing on the subject is included.

The absorbing power of the soil for manganese, P. NOTTIN (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 1, pp. 44–47*).—Experiments are reported from which it is concluded that the lime in arable soils does not react with manganese salts as long as it is in the form of calcite.

Organic matter for the soil (*Rhode Island Sta. Rpt. 1918, pp. 2, 3*).—Where corn was grown continuously equal yields were obtained with legumes and a half stand of rye as cover crops, the former requiring less supplementary nitrogen. A considerably larger yield of corn was produced on soil which had received all except nitrogenous fertilizers for 20 years and on which a sod containing clover was plowed under. The addition of nitrogenous fertilizers only slightly increased the yield.

On the basis of equal additions of organic matter, muck composted with slaked lime gave as good yields of cabbage and late beets as stable manure, but gave smaller yields of lettuce, tomatoes, celery, and fall spinach.

Stable manure gave better yields of celery and tomatoes than green manure and chemical fertilizers and about the same yields of cabbage the following spring. Stable manure alone produced better yields of sweet corn than complete fertilization with chemical fertilizers. Fall plowing of sod gave only slightly better results than spring plowing for potatoes.

Organic matter for the soil (*Rhode Island Sta. Rpt. 1919, pp. 5, 6*).—Green manuring of corn soil with red and sweet clovers produced about 7 per cent more ears by weight than with alfalfa and vetch. Rye as a cover crop without nitrogen produced slightly greater corn yields than legumes. With a legume cover crop, 20 lbs. of nitrogen produced as much corn as four times this amount of nitrogen where rye was used.

Peat, composted with hydrated lime, compared with 16 tons of stable manure indicated no conditions favorable to the use of peat for vegetable growing either in the field or in the greenhouse.

Where oats and peas were plowed under with 8 tons of stable manure, and fertilizer chemicals used prior to setting out celery, the yields of celery and cabbage which followed in the next spring were as high as with 16 tons of stable manure and less fertilizer chemicals. By scattering the fertilizer chemicals about the tomatoes, certain combinations with the green manures compared quite favorably with 16 tons of stable manure and less fertilizer.

In a comparison of nine rapid-growing crops to see which would produce, after the middle of July, the most dry matter for possible humus formation, pearl millet exceeded the others.

Legume nitrogen, C. A. WHITTLE (*South Fert. Assoc., Soil Impr. Com. Bul. 33* [*1920*], *pp. 8*).—This is a review and summary, particularly of the work conducted at the different State experiment stations, on the subject. It is the purpose to show that legumes fall somewhat short of supplying the nitrogen required by crops from soils. It is pointed out that the actual nitrogen recovered from legumes is smaller than is generally believed, and it is recommended that before using legume green manure as a source of nitrogenous fertilizer the cost of growing the legume and turning it under should be computed and compared with the cost of commercial nitrogen and its application.

A preliminary report on the veld-burning experiments at Groenkloof, Pretoria, E. P. PHILLIPS (*So. African Jour. Sci., 16* (*1920*), *No. 4, pp. 285–299, pls. 3, figs. 5*).—Experiments are reported which showed that burning the veld, thus denuding the soil of its protective vegetation, tended to encourage the flowering of many plants, particularly hemicryptophytes, by allowing the access of light and heat. The temperature during both day and night was considerably higher on bare soil than on soil covered with vegetation, but the latter did not exhibit such extremes of heat and cold. Denuded soil absorbed more water after rain than covered soil but lost it more quickly by evaporation. Covered soil showed greater stability in moisture content.

New bases and methods for increasing the soil production of Germany, H. NIKLAS (*Internatl. Mitt. Bodenk., 7* (*1917*), *No. 1–2, pp. 1–38*).—Procedure in the soils survey and soil mapping, supplemented by crop statistics, as practiced in Germany under the stress of war-time conditions to increase the productivity of the soil, is described.

Chemical fertilizers and parasiticides, S. H. COLLINS (*London: Baillière, Tindall & Cox, 1920, pp. XII+273, figs. 9*).—This volume is one of the industrial chemistry series and deals mainly with the sources and methods of manufacture of chemical fertilizers. Information is also given on the uses of chemical fertilizers.

Part 1 deals in general with the need for fertilizers. Part 2 deals with the sources of fertilizers, with sections on mineral deposits of fertilizers, fuel by-

products, metal industry by-products, alkali industry by-products, plant and animal refuse of value as manure, and atmospheric nitrogen. Part 3 deals with the manufacture of fertilizers, with sections on inorganic nitrogen, organic nitrogen, phosphorus and potassium fertilizers, bone manures, and compound manures. Part 4 deals with the use of fertilizers, and contains sections on the trade in fertilizers, the distribution of fertilizers over the rotation of crops, manures. Part 4 deals with the use of fertilizers, and contains sections on the sion is included discussing the future of fertilizers, reference being made to new sources and improvements in their manufacture and use. A final division deals with chemical insecticides and fungicides, and is noted on page 56.

Efficiency of fertilizers and other manures (*Rhode Island Sta. Rpt. 1918, pp. 3, 4*).—One part of phosphoric acid in acid phosphate gave smaller yields of beets than nine parts in floats but larger yields than four parts, and with tomatoes larger yields than nine parts in floats.

Cow manure gave about as good results with hay as chemical fertilizers. The manure and manure and shavings required reinforcement with phosphoric acid for a proper residual effect for subsequent crops, including rutabagas and turnips. Where potash fertilization had been omitted, the yield of hay was considerably increased by additions of common salt or soda ash.

The action of stored lime nitrogen, D. MEYER (*Ztschr. Landw. Kammer Schlesien, 24* (*1920*), *No. 30, pp. 676–678*).—Experiments with lime nitrogen which had been in storage for from 6 to 10 months showed that samples containing as high as 0.93 per cent of dicyandiamid nitrogen gave in general as good results with oats on sandy loam soil as samples containing practically no dicyandiamid nitrogen. The results with a sample containing 1.88 per cent of dicyandiamid nitrogen were much poorer.

It is concluded that storage of lime nitrogen for from 6 to 10 months does not generally reduce its effectiveness as long as it is protected against dampness. Loose storage is possible if the lime nitrogen is covered with layers of Thomas meal and straw. The determination of dicyandiamid is considered to be a safe basis for the judgment of the effectiveness of stored lime nitrogen. If the content of dicyandiamid nitrogen is greater than 10 per cent of the total nitrogen, the effectiveness is rapidly reduced.

The reversion of superphosphates, A. AITA (*Gior. Chim. Indus. ed Appl., 2* (*1920*), *No. 5, pp. 227–233, figs. 2*).—Studies on the reversion of superphosphates made from Costantine, Gafsa, and land pebble phosphates, as caused by compounds of iron and aluminum, are reported.

It was found in general that the reversion of that part of the phosphoric acid soluble in water and citrate solution is closely related to the content of the phosphate in compounds of iron and aluminum and also with the content of free phosphoric acid. The iron and aluminum compounds were apparently the primary cause of reversion, while the free phosphoric acid present had a tendency to neutralize their action. It appeared that reversion proceeded by successive intermediate stages until a state of equilibrium was reached, depending upon the content of the mixture in oxids of iron and aluminum and free phosphoric acid.

It was also found that reversion was apparently arrested when there were present two parts of free phosphoric acid to one part of the oxids of iron and aluminum soluble in water.

Potash from kelp.—III, The preliminary examination of kelp distillates, G. C. SPENCER (*Jour. Indus. and Engin. Chem., 12* (*1920*), *No. 8, pp. 786–792*).—This is the third paper of this series (E. S. R., 43, p. 630) in which investigations are reported, the purpose of which was to determine the nature and com-

mercial value of the distillation products from the kelp treatment process for the extraction of potash as used by the U. S. Department of Agriculture at the experimental plant at Summerland, Calif.

It was found that kelp tar can be separated into groups of compounds which may be designated as tar acids, neutral oils, ammonia, and pitch.

Lime: Its properties and uses, W. E. EMLEY (*U. S. Dept. Com., Bur. Standards Circ. 30 (1920), 2 ed., pp. 25*).—This circular gives general information on the manufacture, uses, and methods of testing of lime, with particular reference to its structural use.

Caustic lime and calcium carbonate as fertilizers, E. RAMANN (*Mitt. Deut. Landw. Gesell., 35 (1920), No. 31, pp. 421–425*).—Experiments are reported which showed that lime is a plant nutrient and must be present in soils in sufficient amounts as such. It also acts in producing proper physical and chemical conditions in soils and in regulating the action of mineral fertilizers. The latter action is considered to be of greater importance than the nutritive action and was found to require much greater amounts of lime.

Caustic lime acted much more rapidly in soils than calcium carbonate. When properly used about equal results were obtained with the two kinds of lime. It is recommended that where mineral fertilizers are applied in the spring, caustic lime be applied in the fall.

The effect of dicalcium silicate on an acid soil, B. L. HARTWELL and F. R. PEMBER (*Soil Sci., 10 (1920), No. 1, pp. 57–60*).—Experiments conducted at the Rhode Island Experiment Station with lettuce on silt loam soil, to determine the fertilizing and neutralizing action of a so-called dicalcium silicate and a hydrated silica, are reported.

It was found that the dicalcium silicate, which contained about 29 per cent of silica and about 47 per cent of calcium oxid, corrected the acid condition of the soil about as well as an equivalent amount of limestone. There was no evidence, however, that the silicon in the dicalcium silicate was of any value.

The fertilizing value of sewage sludge, W. E. BRENCHLEY and E. H. RICHARDS (*Jour. Soc. Chem. Indus., 39 (1920), No. 13, pp. 177T–181T, figs. 3*).—Chemical analyses of activated and slate-bed sewage sludges gave respective contents of nitrogen of 7.09 and 2.63 per cent, phosphoric acid 3.82 and 0.34 per cent, and potash 1.12 and 0.08 per cent.

Nitrification experiments comparing the two types of sludge with dried blood showed that within 15 weeks 26 per cent of the nitrogen is slate-bed sludge was nitrified, 66 per cent of that in activated sludge, and the whole of that in dried blood.

Pot experiments with barley to determine the fertilizing values of the two sludges as compared with sodium nitrate showed that as far as bulk of crop and percentage of dry matter were concerned, the activated sludge compared favorably with sodium nitrate, giving practically an equal return for each unit of nitrogen applied. Slate-bed sludge gave a less marked result, although the increase over the unmanured soils was considerable. The slate-bed sludge proved to be quite a useful source of nitrogen, although unit for unit the increase produced was considerably less than with sodium nitrate or activated sludge.

Further pot experiments with mustard to determine the residual effect of the two types of sludge as compared with sodium nitrate showed that while single dressings of slate-bed and activated sludges had a certain residual manurial value, the actual increase of crop was not of any great significance. Sodium nitrate, however, in similar dressings left a considerable amount of available plant food. "It is clear that activated sludge has a very real manurial value by reason of its relatively high content of nitrogen in a readily available form. The practical difficulty of drying the sludge, containing 98 per cent of water as it comes

from the settling tanks, has yet to be overcome, but if an economic drying process can be found activated sewage sludge promises to become a valuable manure for the farmer and market gardener."

It is further concluded that sludge from slate beds has a definite manurial value, and deserves the attention of farmers and gardeners wherever it is available.

Investigation on the action of guanol, D. MEYER and K. SCHRÖTER (*Bl. Zuckerrübenbau, 27 (1920), No. 11-12, pp. 90-95*).—In a study of the fertilizing action of guanol, pot experiments with mustard on sandy loam soil, and field experiments with potatoes on loamy sand soil and with suger beets on heavy loam soil are reported.

In the pot experiments with mustard better results were obtained when guanol was used with than without stable manure. In the former case the action was relatively small, being only about 68.2 per cent of that of ammonium nitrate. The potato crop was increased somewhat in the field experiments, but there was very little favorable action of the guanol evident on sugar beets.

Further experiments are deemed necessary.

The fertilizing action of Peruvian bark residue, O. NOLTE (*Deut. Landw. Presse, 47 (1920), No. 36, p. 262*).—Pot and field experiments with mustard on light sandy soil to test the value of Peruvian bark residue as a source of nitrogen showed that this residue gave no evidence of having any fertilizing value.

Fertilizers, F. A. LÓPEZ DOMÍNGUEZ and R. V. MAYO (*Porto Rico Dept. Agr. and Labor Sta. Bul. 21 (1919), Spanish ed., pp. 41, pl. 1*).—This bulletin gives the text of the Porto Rico fertilizer inspection law, discusses its operation, and gives information as to the proper sale as well as the proper selection and purchase of fertilizers on the island.

Actual and guarantied analyses of 104 samples of fertilizers and fertilizer materials collected for inspection in Porto Rico during the fiscal year 1918-19 are also reported, together with a summary and an analysis of deficiencies. Actual and guarantied analyses of 53 unofficial samples of fertilizers offered for sale on the island during the fiscal year 1918-19 are also included.

AGRICULTURAL BOTANY.

Heritable characters of maize.—I-III (*Jour. Heredity, 11 (1920), Nos. 1, pp. 3-6, pl. 1; 2, pp. 65-76, figs. 8; 3, pp. 111-115, figs. 3*).—A series planned to describe and illustrate heritable variations in maize. Alternative characters in this plant are coming to notice in such numbers as to suggest strongly that maize may rival Drosophila as material for study of the linear arrangement of factors and of chromosomes as bearers of the determinants of characters.

I. *Lineate leaves,* G. N. Collins and J. H. Kempton.—The character here described as lineate leaves, a fine striping on the blades of the upper leaves beginning about the tenth, was first observed in four progenies of sweet corn growing at Lanham, Md., in 1918, this being a hybrid between Stowell Evergreen and a prolific field corn from Brownsville, Tex. Details are given of the history after the original crossing in 1912.

Seeds from six selected ears were planted in 1919 and lineate plants appeared in all of the progenies. These, however, were not alike in this respect, this character being extremely variable in expression. Attempts to estimate the degrees of lineation resulted in a scale of 10 grades which, though arbitrarily adopted, were found to be workable by independent observers.

Except in case of two green plants found in the progeny of a self-pollinated lineate plant, the breeding results agree well with the expectation of Mendelian behavior based on the assumption that lineation is a simple Mendelian character

recessive to the normal form. The two green plants are to be tested during the coming season.

In addition to the 6 ears above noted, there were 12 hand-pollinated ears from related progenies which produced no lineate plants in 1918. Seeds from these were planted in 1919, and the progeny of five produced some lineate plants. The facts are discussed in connection with hypotheses which are suggested.

II. *Pistillate flowered maize plants*, R. A. Emerson.—This paper reports studies on the progenies of two maize plants under observation and genetic study, one since 1914, the other since 1915. Both of these had wholly pistillate inflorescences, but the first presents a type which is called tassel seed, the other a type called tassel ear. These types are described with discussion. Though at first supposed to be identical (arising, however, in unrelated lots of maize), the two types are now held to be entirely distinct. The two characters have been shown to be linked and recessive.

The terminal inflorescences of both tassel seed and tassel ear maize are much more susceptible to smut than are normal inflorescences.

III. *Brachytic culms*, J. H. Kempton.—The maize variation here considered consists in a shortening of the internodes on the main culm and lateral branches without a corresponding reduction in their number or in the number and size of other organs. It arose in 1917, being grown in F_2 from self-pollinated seeds. Statistical data secured for several characters in both the normal and the brachytic progenies are given with discussion.

On Mendelian inheritance in crosses between mass-mutating and non-mass-mutating strains of Œnothera pratincola, F. Cobb and H. H. Bartlett (*Jour. Wash. Acad. Sci., 9 (1919), No. 16, pp. 462-483*).—A progress report in the nature of a preliminary abstract has been noted (E. S. R., 41, p. 821). The present paper gives a somewhat detailed account of the work done in this direction so far as it is now ready for publication.

In connection with brief discussion of the strain known as Lexington E, previously noted, it is stated that there are relatively stable strains of *Œ. pratincola* such as the one designated Lexington C, which throw small numbers of flat-leaved mutations belonging to several groups, one of the most characteristic being the mutant *nummularia*. The production of this mutant, which is never thrown by the strain which originates revolute-leaved mutations, is claimed to be due to mutation in the *a* portion of the alpha gamete, but nevertheless dependent for its expression upon the presence of the Mendelian factor F for flatness. (It is recalled in this connection that *nummularia* shows matroclinic inheritance in crosses with the parent form.)

The basic assumptions are discussed in connection with their supposed bearings and consequences. Results indicated are regarded as affording not only one of the best examples of Mendelism in Œnothera hitherto adduced, but also as giving an indication as to when Mendelian behavior, as opposed to matrocliny or patrocliny, is to be expected.

History of the Mexican grass, Ixophorus unisetus, A. S. Hitchcock (*Jour. Wash. Acad. Sci., 9 (1919), No. 18, pp. 546–551*).—This account deals with the history, synonymy, and distribution of *I. unisetus*.

Studies in the physiology of the fungi.—VI–X (*Ann. Missouri Bot. Gard., 6 (1919), Nos. 2, pp. 93–136, 137–142; 3, pp. 183–192, 193–200, 201–222, pl. 1, figs. 5*).—These papers continue the series previously noted (E. S. R., 38, p. 524).

VI. *The relation of bacteria to cellulose fermentation induced by fungi, with special reference to the decay of wood*, H. Schmitz.—The purpose of this study was to determine whether or not cellulose-dissolving bacteria are habitually present on decaying wood under natural conditions and their influence, if any, on the rate of decay, also to determine whether the ordinary saprophytic forms

affect the cellulose-dissolving proclivities of the fungus causing the decay, by changing the reaction of the substratum so that it may be more or less favorable for optimum growth.

It was found that wood sterilized by autoclaving undergoes certain changes which should be considered when using such wood for experimental purposes in connection with wood-decaying fungi. Among the changes noted are a change in color; an increase in amount of reducing substances in the extract, also in its acidity; an increase in the H-ion concentration of the extract; and a change in response toward decay. It is believed that cellulose-dissolving bacteria play no important part in the decay of wood under natural conditions, though the rate of decay may be materially increased by the presence of ordinary saprophytic bacteria. The influence of bacteria on fungi with reference to the rate of decay caused by the fungi varies with the different fungi on different woods.

VII. *Growth of wood-destroying fungi on liquid media*, S. M. Zeller, H. Schmitz, and B. M. Duggar.—The authors carried out experimentation to determine which fungi are adapted to grow on liquid media and what liquid media are suitable to their growth, also the influence, if any, of the H-ion concentrations in such media.

It was found with respect to the six media employed as indicated and the eight species studied, that *Merulius pinastri*, *Polyporus lucidus*, *Polystictus versicolor*, *Pleurotus sapidus*, and *Trametes peckii* grew best in the order indicated. Others grow well only on certain media, for example, *Lenzites vialis*, *Dædalea quercina*, and *M. lacrymans* on Richards' solution.

In the solutions studied the H-ion concentration appears not to be the limiting factor in growth nor the factor (within the limits studied) determining a desirable medium. The shifting of the H-ion concentration due to metabolism depends upon both the fungus and the medium. No general statement is attempted concerning the relation between the H-ion concentrations of the culture media and the growth of wood-destroying fungi as a group.

VIII. *Mixed cultures*, S. M. Zeller and H. Schmitz.—The purpose of this work was to study in mixed cultures the behavior of fungi such as *Lenzites vialis*, *Merulius pinastri*, *M. lacrymans*, *Dædalea quercina*, *D. confragosa*, *Trametes peckii*, *Pleurotus sapidus*, *Lentinus lepideus*, *Coniophora cerebella*, *Polystictus versicolor*, *Isaria* sp., *Polyporus lucidus*, *Polystictus hirsutus*, *Aspergillus glaucus*, *A. niger*, *A. fumigatus*, *A. versicolor*, and *A. sydowi*.

The authors grew all of these fungi on 2 per cent agar plates prepared in the same manner as in the work above indicated. Brief notice of acceleration or retardation is given with discussion.

The results were observed to agree with the view that fungi in their growth show a more marked tendency to grow out and away from the medium influenced by their own growth metabolism than to grow toward a diffusion center where the materials contained in this center are nutritive or deleterious. It is thought that this may also be the condition produced in stale cultures.

IX. *Enzym action in Armillaria mellea, Dædalea confragosa, and Polyporus lucidus*, H. Schmitz and S. M. Zeller.—The purpose of the authors was to investigate some of the fundamental relations between fungus and host. This is said to be the first of a series of studies concerned especially with enzym activities of such forms.

The fungi employed were grown on sterile sliced carrot, rapidly air-dried and ground into a fine meal, which was examined.

Enzyms demonstrated as present include esterase, maltase, lactase, sucrase, raffinase, diastase, inulase, cellulase, hemicellulase, emulsin, tannase, urease, amidase, and trypsin and erepsin when fibrin is used as a substratum.

A new method for determination of ammonia liberated by amidase is described. This method involves the application of the indicator method for H-ion concentration determination.

X. *Germination of the spores of certain fungi in relation to H-ion concentration*, R. W. Webb.—Employing methods as described in articles by Clark (E. S. R., 11, p. 910) and by Duggar (E. S. R., 13, p. 528) the author tested spores of several fungi as named. The results reported are considered to show that in a culture solution consisting of 0.2 M mannite, phosphoric acid, and sodium hydroxid successively increasing concentrations of H-ions from neutral or approximately so to pH 3.1—2.8 favorably influence germination of the spores in the case of *Aspergillus niger*, *Penicillium cyclopium*, *Botrytis cinerea*, *Fusarium* sp., and *Lenzites sepiaria*.

The range and percentage of germination as influenced by H-ion concentration vary with the organism. With increase of intervals of incubation, the relations of germination to H-ion concentration remain practically the same. Whether incubated at 22, 27, or 31° C., the curves of germination for any organism are practically identical.

Studies on proliferation of inner cells of the stem in Vicia faba, Y. Okada (*Bot. Mag. [Tokyo], 34 (1920), No. 399, pp. 19–34, figs. 8*).—The author found that a high degree of proliferation of the inner stem cells of *V. faba* could be induced by the daily injection of pure water. This change appeared to be associated with the increase of turgor, solutions of such salts as those of copper and zinc having a like but less marked effect. Low temperature hinders this process, in which cell division is apparently not affected and by which the normal activity of the membranes is not materially altered. In the proliferating cells increase of acid could be demonstrated, as also could be a substance staining red with hydrogen dioxid.

H-ion concentration and the composition of nutrient solutions in relation to the growth of seed plants, B. M. Duggar (*Ann. Missouri Bot. Gard., 7 (1920), No. 1, pp. 1–49, figs. 7*).—In experimentation described as carried out in the greenhouse at different periods of the year and as representing a considerable range of environmental conditions, the author found that three solutions, which are described in detail, yielded excellent growth, although special adaptations are noted.

It is concluded that there may be no single best solution for the growth of any of the three plants used in these experiments. In all probability a best solution, like the optimum temperature, is represented within the optimum concentration rather by a considerable range of salt or ion proportions, influenced to a greater or less degree by environmental factors.

The supposed resistance of dry plant protoplasm to absolute alcohol, ether, and other anesthetics, A. Rippel (*Biol. Zentbl., 37 (1917), No. 10, pp. 477–498*).—It is claimed that a supposed immunity to injury by pure alcohol, ether, and other anesthetics and by undiluted organic substances is not supported by the evidence obtained in these investigations. Cellulose and certain modifications thereof are, on account of their colloidal characters, deemed impermeable to such substances, so that the explanation of such immunity rests upon a purely mechanical basis.

Carbon monoxid, a respiration product of Nereocystis luetkeana, S. C. Langdon and W. R. Gailey (*Jour. Wash. Acad. Sci., 9 (1919), No. 18, p. 560*).—The data contained in this paper were obtained at Puget Sound Marine Station in an investigation to determine whether the carbon monoxid present in the pneumatocysts of the giant Pacific coast kelp is a step in photosynthesis or a respiratory product. Carbon monoxid was formed only when oxygen was present in the gas and was produced as readily in darkness as in light. Its

formation is therefore regarded as related to respiration rather than to anabolic processes. See also a previous note (E. S. R., 36, p. 804).

Apparatus for measurement of oxidase and catalase activity, R. B. HARVEY (*Jour. Gen. Physiol., 2 (1920), No. 3, pp. 253, 254, fig. 1*).—A modification is described of the Bunzel simplified oxidase apparatus (E. S. R., 32, p. 508). This is claimed to eliminate the chief defect of such apparatus by employing a caustic tube and alkali to absorb the carbon dioxid produced in the reaction. It is stated that the apparatus can be conveniently employed for the determination of catalase activity.

FIELD CROPS.

[Report of field crops work in Hawaii, 1919], H. L. CHUNG, F. G. KRAUSS, and R. A. GOFF (*Hawaii Sta. Rpt. 1919, pp. 44–49, 60–67, 68, 69, 70–72, 73, pls. 4*).—The progress of work previously noted (E. S. R., 41, p. 137), including variety, cultural, and fertilizer tests, breeding work, and distribution of planting stocks of new varieties, is described.

Guam corn, a white variety, produced at the rate of 52.5 bu. per acre at the Honolulu Station in 1919. While this variety is said to be resistant to leaf hoppers and is prolific, the demand for a yellow corn in Hawaii limits its production. A bean mutation of the Early Refugee variety, No. 1167, and several sweet potato seedlings gave considerable promise on account of superior edibility. The round field turnip (*Brassica rapa*), from China, made a calculated yield of 43.5 tons per acre.

Unusual drought is said to have retarded crop growth at the Castner Substation. Edible canna was found desirable for either a soiling crop or for starch production, as it made average yields of 20.36 tons of tubers and 12.9 tons of tops in 14 months in spite of the dry weather. Giant White carrots and Long Red mangels produced roots weighing 6 and 12 lbs., respectively, in 10 months, without irrigation, while cassava made very poor growth. Potato tests were made impracticable by the drought, the seed drying before it could sprout. Annual white sweet clover made satisfactory growth, while an attempt to produce alfalfa without irrigation proved unsuccessful. Certain grasses remained green in spite of the drought, Merker grass (*Penniscetum merkeri*), growing luxuriantly and stooling heavily.

In a test conducted at the Haiku (Maui) Substation, in cooperation with the Office of Corn Investigations of the U. S. Department of Agriculture, comparing island and mainland corn varieties at different elevations, Selection No. 133, the only corn variety to mature ears during the fiscal year ended June 30, 1919, yielded at the rate of 40 bu. per acre in an unduly dry season. A strain of New Era 100-day Yellow Dent, requiring a growing season of 20 days longer than the parent variety, has been developed for localities having ample rainfall. The necessity for phosphatic fertilizers in order to obtain profitable corn yields was indicated in fertilizer tests, in which an application of 500 lbs. per acre of a mixture of equal parts of reverted and superphosphate rendered the most economical results.

Pigeon peas seemed to combine more good points with fewer unfavorable characteristics than any of over 100 other forage crops.

In a combined variety test, inoculation, and fertilizer experiment with 13 varieties of alfalfa, treatment with pure cultures of tubercle organisms, applications of 1 ton of hydrated lime, 250 lbs. of potassium sulphate, or 100 lbs. of dried blood and nitrate of soda failed to produce better growth than the checks and the plants died as did those in the check plats. Stable manure at the rate of 20 tons per acre produced a fair growth, but the best results, as with corn,

were obtained from plats receiving 500 lbs. of a mixture of reverted and superphosphate. Hairy Peruvian, yielding 28 tons of green forage per annum in 12 cuttings, was first, followed by the smooth type of Peruvian, which gave about 25 tons of green forage in from 10 to 11 cuttings. Common alfalfa averaged 20 tons in 8 cuttings, and although Grimm and Siberian varieties gave promise for pastures, the yields were too low to recommend their planting for hay.

Results of potato experiments, covering four successive seasons, indicated the need of a green manure, supplemented by a liberal application of commercial fertilizer to produce profitable yields. Treatment with 500 lbs. of either superphosphate or reverted phosphate in the hills at planting time gave an increase of from 150 to 400 per cent over untreated plats. Two-oz. seed pieces, bearing at least two eyes, planted when the newly sprouted shoots were about ¼ in. long, gave the best results in potato planting tests. The earlier varieties, which usually escape the blight and mites, have yielded decidedly better than the later maturing sorts, the New Era Earliest of All producing at the rate of 300 bu. per acre. The Burbank varieties made a low average yield, due to late maturity and consequent blight and mite damage. After the failure of 3 years' selection work to produce a variety immune to blight, the authors consider the best available practice on Maui to consist of growing early varieties suited to conditions and spraying them several times during the latter half of the growing season.

Hamakua Hybrid and Portuguese Red potatoes proved profitable at the Glenwood (Hawaii) Substation, yielding from 90 to 120 bags (100 lbs. each) of marketable tubers per acre. In limited fertilizer tests the use of 250 lbs. each per acre of superphosphate and sodium nitrate was found most economical. Plats receiving reverted and superphosphate in cooperative tests returned a yield 30 per cent larger than the check. Applications of from 20 to 30 tons of stable manure gave the largest yields of Maui Red beans. Alfalfa yielded from 20 to 30 tons of green feed per acre in 9 cuttings. Planting tests with this crop indicated that drilling seed in rows 2 ft. apart was the method best suited to local conditions. Sweet clover, edible canna, Australian water grass (*Paspalum dilatatum*), cassava, and pigeon peas all gave promise as valuable sources of stock feed. Taro gave indications of value where potatoes and cabbage do not thrive. Waimea White corn gave the highest yields of 3 varieties, producing 2,600 lbs. of corn per acre with stable manure, and 2,415 lbs. with 400 lbs. of phosphate applied before planting. Plant crops of sorghum averaged 22 tons of green feed per acre, but ratoon crops were very inferior and stunted.

[Report of field crops work at the Dickinson Substation, 1919], L. Moomaw (*North Dakota Sta. Bul. 138 (1920), pp. 10–24, figs. 4*).—Variety and cultural tests with various field crops conducted during the year in cooperation with the U. S. Department of Agriculture in continuation of similar work already reported (E. S. R., 42, p. 732), are described. The summer of 1919 is noted as the most adverse on record from the standpoint of crop production.

The leading varieties and their yields per acre were as follows: Monad (D-1), a durum wheat, 6.4 bu., Marquis wheat 3.4 bu., Turkey (N. D. No. 1997) wheat 3.7 bu., Victory oats 4.5 bu., Golden Rain, a midseason oats variety, 3.6 bu., Kherson oats 6.2 bu., Hannchen barley, a 2-rowed variety, 1.9 bu., Gatami, a 6-rowed barley, 4.9 bu., Russian flax (C. I. 19) 3.9 bu., Gehu, a flint corn, 19.1 bu., Northwestern Dent corn 18.5 bu., Minnesota 13 corn 4,843 lbs. total weight, Gold Mine millet 2,000 lbs., Sudan grass 1,700 lbs., and sunflowers 6,015 lbs. The average yields for the period 1913–1919 of Monad, Marquis, and Turkey wheats were 23.1, 17, and 13.5 bu. per acre, respectively. The 13-year average yield of oats varieties was 52.7 bu. for Victory, 49.3 bu. for Golden Rain, and 46.1 bu. for Kherson. The average acre-yield for 12 years was 31.3 bu. for

Hannchen barley and 25.1 bu. for Gatami. Where flax was grown on brome sod in a rotation, the yield averaged 8.09 bu. for 13 years.

Comparison of different cropping methods followed during the period 1908–1919 indicated that the highest average yields of wheat, 23.9 bu., and oats, 47.3 bu., were obtained on summer fallow, and barley, 30.4 bu., on disked corn ground. The increase in yield with wheat, 2.6 bu., and oats, 3.9 bu., was so small, however, that extensive fallowing was not deemed justifiable as a farm practice, when a crop as valuable as corn could be sown. Wheat and barley produced slightly higher yields on fall plowing than on spring plowing, while oats yielded better on lands spring plowed. Green manure turned under in midsummer did not prove profitable, as neither wheat nor oats yielded more following this method than after corn.

Russian thistle, usually a troublesome weed in dry years, yielded at the rate of 5.7 tons of air-dry material per acre. It appears that the best results in feeding have been obtained by cutting for hay about the time the bloom appears and before the stems become too harsh and prickly. Local practices indicate that it is desirable to mix some other form of roughage with the thistle, and sprinkle some concentrate, such as oats, bran, or black strap molasses, over the hay or chopped material.

The yields of potatoes were said to be the lowest ever reported at the station, Irish Cobbler leading the test of varieties with a yield of 72 bu. per acre, 55 per cent of which were marketable stock. Burbank yielded but 50 bu. with a marketability of 60 per cent. Burbank, with an average yield of 103 bu. per acre, led in the three crops, 1917, 1918, and 1919, followed by Irish Cobbler with 94 bu.

[Report of work with field crops in Rhode Island, 1918] (*Rhode Island Sta. Rpt. 1918, pp. 5–8*).—In continuation of work previously noted (E. S. R., 40, p. 133), this reports variety and fertilizer tests, and studies of the effect of crops on each other.

Maximum acre yields in the variety tests were produced by Eureka and Early Mastodon silage corn with 27 tons each, Thomas Laxton peas with 268 bu., White Kidney beans with 26 bu., Hollybrook soy beans with 11.8 tons of silage, Amherst and Elton soy beans with 21 bu. each of beans, and Norcross potatoes with 386 bu.

From 70 to 80 bu. of corn were produced on sod with chemical fertilizers alone, regardless of whether 60 or 80 lbs. of nitrogen, 50 or 100 lbs. of phosphoric oxid, and 60 or 120 lbs. of potassium oxid were applied either broadcast or in the hills. A spring top-dressing of 125 lbs. of sodium nitrate, 300 lbs. of acid phosphate, and 100 lbs. of potash salt produced a yield of 29 bu. of winter rye and 1.66 tons of straw. Decreasing the fertilizer by one-third reduced the yield to 18 bu. of grain and 1.2 tons of straw.

Phosphorus requirement studies showed that carrots secured their entire needs under conditions where turnips were practically unable to grow without phosphatic application; millet and tomatoes ranked next to carrots; and beets and rape next to turnips.

The marked effects of preceding crops on onions was shown by yields of 92 bu. of onions after beets, 288 bu. after beans, 319 bu. after onions, and 400 bu. after endive on an acid soil. A variation of but 485 to 590 bu. was observed when considerable lime was added. Barley was planted on acid soil where alfalfa, barley, beets, and carrots had been planted singly in the five preceding years. Even though beets could not make a satisfactory growth, they and carrots were followed generally by the poorest growth of barley. The best barley on the unlimed plats grew after barley. On the limed plats, however, the growth of barley was even greater after beets than after barley.

[Tests with field crops and vegetables at the Rhode Island Station] (*Rhode Island Sta. Rpt. 1919, pp. 8, 9, 10–13*).—Northern White Dent with 6.4 tons of ears and a total yield of 19.8 tons, and Improved Learning with 5.7 tons of ears and a total of 18.6 tons, led in the test of silage-corn varieties. When allowed to remain in the field the highest yielders were found to be the latest in maturing. Seed corn from detasseled plants failed to make an increase in yield over that from plants not detasseled. Two years' observation on different methods of fertilizer distribution showed but little variation in the yield of hard corn from this cause. Early Dawn made the earliest as well as the highest yield of sweet corn, producing 252 doz. of ears having a total weight of 1,208 lbs. Golden Bantam, although lowest in ear production, 199 doz., produced the highest total weight, 1,542 lbs.

Though low in seed production, Mongol and Haberlandt soy beans were the highest in a comparison for silage purposes. Long Island made the best yield of rutabagas, while Jones Red Wave and Red Chaff were leaders in the winter wheat tests. Southport Red Globe onions with 601 bu. proved superior to Danvers Yellow Globe with 430 bu.

Green Mountain, the principal potato variety grown, yielded about 400 bu. Unusual weather conditions were held to have produced 11 lbs. of rotten for each 100 lbs. of sound potatoes in case of the high-yielding group of varieties compared with 3 lbs. of rotten ones in the smaller-yielding group.

In a 5-year rotation of rye, clover, grass, corn, and potatoes, the addition of a total of 190 lbs. of nitrogen in the potato fertilizer made a total increase of 173 bu. of potatoes for three crops over the yields of plats without nitrogen. In the same rotation with similar fertilizer conditions, differing only in phosphorus, 360 lbs. of phosphoric oxid gave a total increase for two crops of but 9 bu. more than 180 lbs of phosphoric acid; differing only in potassium, 320 lbs. of potassium oxid gave a total increase for two crops of 35 bu. over 160 lbs. of potassium oxid.

Carrots secured their entire need of phosphorus where that element was quite unavailable in the soil, but turnips and cabbages were practically unable to grow without phosphatic application. Beans, wheat, and oats ranked between these extremes In solution experiments with limited phosphorus, oats produced a more nearly normal growth than wheat.

In lime requirement tests, tobacco plants set out in acid soil made a satisfactory growth, indicating that acid conditions were not wholly deleterious to tobacco. Spinach proved to be an efficient indicator in detecting variations in soil acidity by showing the need of adequate additions of lime where sulphate of ammonia was used as a substitute for nitrate of soda for crops extremely sensitive to acid-soil conditions. In another experiment, barley, alfalfa, carrots, and mangels responded to lime in the increasing order named. Lime was observed to have an additional value in discouraging the growth of the cabbage clubroot organism.

Plant propagation (*Rhode Island Sta. Rpt. 1919, pp. 14–16*).—In tests at this station, potatoes showed but slight differences whether obtained from Maine in 1914, 1915, 1916, or 1917 and grown in Rhode Island since. Tubers weighing 2, 3, and 4 oz., cut into 2, 3, and 4 pieces, respectively, made respective yields of 286, 228, and 236 bu. per acre.

Seed of Rhode Island White Cap corn chosen from areas where the backward tassels had been removed made better yields than the progeny of high producers in either ear-to-row tests or seed field-selected. In a field demonstration suggested by the Bureau of Plant Industry, U. S. Department of Agriculture, three varieties planted April 25 produced average yields of 49.3 bu. of hard corn and 4 bu. of soft corn per acre, as compared with 44 bu.

hard corn and 7.3 bu. of soft corn from seed planted May 24. The average weight of 100-ear selections from the early plantings was 46.6 lbs. and from the late plantings 39.3 lbs. From the proportion of hard to soft ears, the early planting was judged more mature in the case of each variety. Topped corn produced 1,521 lbs. of hard ears and 127 lbs. of soft ears, as compared with 1,385 lbs. of hard and 367 lbs. of soft ears from shocked corn, indicating that a more complete maturity was obtained by topping.

Effect of crops on each other (*Rhode Island Sta. Rpt. 1919, pp. 12, 13*).—In work conducted at this station on a soil with some deficiency of phosphorus, the yield of rutabagas increased in the order named when following 1918 crops of rape, carrots, rutabagas, tomatoes, and spring wheat. In both 1918 and 1919, the yields of late cabbage grown subsequently during the same season increased in the order named after peas, beets, potatoes, and spinach. Observations on pot experiments as well as field tests showed that on acid soils onions made a good growth after timothy and redtop, but fared poorly following buckwheat and rutabagas In pot experiments with acid field soils, lettuce produced relative weights of green leaves as follows: After beets 16, after carrots 41, after alfalfa 78, and after barley 113. With the addition of liberal quantities of lime, the weight of lettuce leaves was about 175, regardless of the preceding crop.

A mixture of silage corn and soy beans at the rate of 12 and 30 lbs., respectively, produced a green weight of 10.5 tons of corn and 1.13 tons of beans per acre. Where planted separately, the corn weighed 15 tons and the beans 4.42 tons, indicating that planting 17 lbs. of corn on 0.7 acre and 18 lbs. of beans on 0.3 acre would equal the yield where the mixed seed was planted. It did not appear from these results and those noted in previous work (E. S. R, 40, p. 135) that anything was gained through the interaction of corn and beans.

Fire and grass seed, W. A. Linklater (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 6, p. 96*).—The author recommends burning and subsequent seeding of cut-over lands in western Washington to provide pastures for cattle and sheep. The early fall is considered to be a specially good season for effective work, the fire killing the green brush and second-growth trees and leaving the land covered with a thin layer of ashes. To secure a good stand, seeding should be made early enough in the fall that germination may occur before fall and winter rains wash away or pack the ashes. Permanent pasture mixtures suitable to different soil conditions are suggested.

Effect of alfalfa on the subsequent yields of irrigated field crops, C. S. Scofield (*U. S. Dept. Agr. Bul. 881 (1920), pp. 13*).—This bulletin describes experiments conducted at three different stations in the northern Great Plains to determine the effect of a period of two or three years of alfalfa in a rotation on the subsequent yields of potatoes, oats, and sugar beets grown under irrigation. A comparison between the yields of these crops when grown in the same sequence but without alfalfa was also made. The author reports a further comparison with potatoes and sugar beets as to the relative effect of a period of alfalfa and the application of farm manure at the rate of 12 tons per acre once during the rotation. Observations on the field tests may be summarized as follows:

In the work at the Scottsbluff Substation in cooperation with the Nebraska Experiment Station it was noted that on the light sandy loam soil the effect of alfalfa was to increase the yield of potatoes about 100 bu. per acre, to increase the proportion of marketable potatoes about 12 per cent, to increase the yield of oats about 6 bu. per acre, and to increase the yield of sugar beets 3.4 tons per acre.

Results secured at the Huntley Substation in cooperation with the Montana Experiment Station, on a very productive clay loam soil, indicated that alfalfa effected an increase in yield of about 50 bu. of potatoes per acre without increasing the proportion of marketable stock, already high on all plats. The alfalfa apparently increased the yield of oats about 11 bu. per acre and the yield of sugar beets about 1.5 tons per acre.

At the Belle Fourche Substation (S. Dak.), on a heavy clay loam rich in organic matter, no beneficial effect from alfalfa was observed on the subsequent potato crop and the effect on oats and sugar beets was too slight to be regarded as significant.

Although the use of farm manure gave excellent returns, alfalfa proved distinctly more beneficial with potatoes at Scottsbluff. With the other crops and at the other stations the differences between the effects were less striking, and in general farm manure produced the best results.

Alfalfa (*U. S. Dept. Agr., Dept. Circ. 127* (*1920*), *pp. 4*).—Brief instructions are given on cultural methods and field practices adapted to growing the crop in Pennsylvania, West Virginia, northwestern Maryland, and northern New Jersey.

The inheritance of the length of internode in the rachis of the barley spike, H. K. Hayes and H. V. Harlan (*U. S. Dept. Agr. Bul. 869* (*1920*), *pp. 26, pls. 2, figs. 2*).—This bulletin reports studies on the inheritance of the length of internode in the rachis of the barley spike, conducted in cooperation with the Minnesota Experiment Station. Measurements of the spike density (length of internode) of the pure-line barley parents, including the 6-rowed varieties Manchuria, Reid Triumph, and Pyramidatum, and the 2-rowed varieties Hanna, Steigum, Svanhals, Jet, and Zeocriton, and of successive generations of their pure-line and hybrid progeny are tabulated and fully discussed. *Hordeum deficiens* was also included, but was not used in any of the crosses.

The length of internode was computed from the measurements of 10 internodes in the middle of the spike. Second measurements, made after a lapse of 3 weeks on the populations from which the density of 3 parents was determined showed that the observational accuracy was such that differences in density greater than 0.2 mm were significant when the measurements were taken in the middle part of the spike. Except in the Hanna and Steigum varieties the seasonal fluctuations in the means of the parents were not found to be more than 0.2 mm. The seasonal variations in the means of the 2-rowed were greater than in the 6 rowed varieties.

The density of the F_1 generation does not seem to have an unvarying relation to the density of the parents as in the Svanhals×Manchuria cross density was dominant in the F_1 generation, while in the Pyramidatum×Jet cross it was intermediate. The two F_1 generations grown were no more variable than the parental sorts, and all crosses gave segregation in F_2. Although the number of F_2 plants grown averaged no greater than that of the parental forms, the frequency ranges extended from the modal class of one parent to the modal class of the other and often beyond these classes. The F_3 generation contained progeny groups which were no more variable for length of rachis internode than pure lines of the parents. Rather extensive studies of a number of F_4 generations gave the authors further evidence of purity of several of those F_3 lines.

The Manchuria×Svanhals and Pyramidatum×Jet crosses gave forms homozygous for densities similar to those of the parents but none homozygous for intermediate densities. Crosses between Hanna and Reid Triumph and between Hanna and Zeocriton gave types homozygous for densities intermediate between the densities of the parents, as well as near those of their parents. The latter cross produced homozygous forms similar to Reid Triumph,

Hanna, and their homozygous intermediates, as well as forms like the Zeocriton parent. The range of means of these homozygous forms was almost continuous, although an indication of two centers of intermediate density was noted. It is believed that more extensive study would be needed to determine whether these apparent centers are of any significance.

The authors conclude from the investigations that "internode length in the barley rachis is a very stable character, which is much less affected by environmental conditions than many size characters. Segregation occurs in the F_2 generation of crosses and forms homozygous for density appear in this generation, their purity being demonstrated in the F_3 generation. In some crosses new lines with densities differing much from those of their parents can not be secured, while in others lines with very different densities may be isolated.

"The inheritance of internode lengths may be interpreted on the factor hypothesis. Some of the crosses studied appeared to differ by a single main factor of density, while in others two or three main factors are necessary to explain the genetic results. Minor factors were evident whose number or nature was not established and through whose action the means of homozygous forms of intermediate densities in some crosses may become more or less continuous between the means of the parents."

Occurrence of the fixed intermediate, Hordeum intermedium haxtoni, in crosses between H. vulgare pallidum and H. distichon palmella, H. V. HARLAN and H. K. HAYES (*Jour. Agr. Research* [U. S.], *19* (1920), *No. 11, pp. 575–591, pls. 4*).—This paper, a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, and the Minnesota Experiment Station, describes the occurrence of *H. intermedium* and other segregates in the progeny of a cross of Manchuria and Svanhals barleys. The Manchuria, a 6-rowed variety, possesses fertile and long-awned side florets, while the Svanhals parent is a well known 2-rowed variety with long-awned, fertile, central florets and awnless, rounded, sterile lateral ones. *H. intermedium* is a form of barley in which the awnless lateral florets exhibit a fertility greater than that found in the 2-rowed and less than that occurring in the 6-rowed barleys. The authors review the history of intermediate barleys, and classify the 87 F_2 plants of the cross and their F_3 progeny into genetic groups according to the nature of their lateral florets.

Although its occurrence as a homozygote has been questioned frequently, *H. intermedium* forms which are stable under all conditions of culture have been isolated from numerous crosses reported in this paper. This form appears to be genetically as distinct as either *H. vulgare* or *H. distichon*.

A 2-factor hypothesis for fertility in the lateral florets is suggested by the authors. On the presence-and-absence hypothesis the 6-rowed barleys are supposed to be homozygous for the presence of the epistatic factor, the *intermedium* to be homozygous for the presence of the hypostatic factor and for absence of the epistatic factor, and the Svanhals to be homozygous for the absence of both factors. According to the hypothesis, there are two types of 6-rowed barleys. The Manchuria parent is supposed to be homozygous for the presence of both factors, while certain regressive 6-rowed segregates are thought to be homozygous for the presence of the epistatic factor and for the absence of the hypostatic factor.

Evidence suggestive of a third factor which affects the vigor of the lateral florets and their percentage of fertility is also noted.

Chicory: Control and eradication, A. A. HANSEN (*U. S. Dept. Agr., Dept. Circ. 108* (*1920*), *pp. 4, fig. 1*).—This gives a brief popular description of the plant and discusses its uses as a pot herb, as a coffee substitute and adulterant, and for forage. Hand pulling, frequent hoeing, and grubbing are considered

to be the most effective methods for control in gardens, but where the weed infests such large areas as to render hand methods impracticable, eradication is best accomplished by growing a tilled crop, such as corn or potatoes, for at least 2 years.

Growing crimson clover, L. W. Kephart (*U. S. Dept. Agr., Farmers' Bul. 1142, pp. 20, figs. 8*).—This publication is a revision and enlargement of Farmers' Bulletin 550, noted previously (E. S. R., 29, p. 633).

The selection of seed corn in Porto Rico, H. C. Henricksen (*Porto Rico Sta. Circ. 18 (1920), pp. 22, figs. 7*).—This circular comments briefly on the object of seed selection, describes important ear and kernel characters, discusses the selection of desirable seed ears, and explains the technique of judging seed corn with the aid of score cards. The author outlines the ear-to-row method of selection, and includes instructions for the preservation of seed corn.

Control of corn rots by seed selection, J. R. Holbert (*Illinois Sta. Circ. 243 (1920), pp. 4, figs. 4*).—Brief directions for the selection, curing, and storage of disease-free seed corn are presented. The best method that has been developed to date in investigations conducted in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, for the control of the rot diseases of the corn root, stalk, and ear is considered to be the selection of mature ears of medium size, from upright sturdy plants whose stalks and portions of the leaves are still green, and whose ears are supported at a convenient height on strong, sound shanks. The field selection should be made before the first killing frost in order to distinguish ears that have matured normally from those ripened prematurely on account of disease.

Cowpeas: Culture and varieties, W. J. Morse (*U. S. Dept. Agr., Farmers' Bul. 1148 (1920), pp. 26, figs. 10*).—A practical treatise on the soil and climatic adaptations of the crop and the field practice and cultural methods employed in its production. Descriptions of the more important varieties are included, together with a discussion of the uses of cowpeas in mixtures and notes on diseases and insect pests. In comparing cowpeas with velvet beans and soy beans, the author observes that in the regions adapted to these crops cowpeas succeed for general purposes under a greater diversity of conditions.

Spur feterita (*U. S. Dept. Agr., Dept. Circ. 124 (1920), pp. 4*).—A brief description of a new and distinct variety of feterita developed at the Spur Substation of the Texas Experiment Station, together with notes on planting, cultivation, harvesting, feeding, and seed production.

Experiments with flax on breaking, C. H. Clark (*U. S. Dept. Agr. Bul. 883 (1920), pp. 29, figs. 3*).—Studies comprising plat and nursery-row experiments with flax varieties, selections, hybrids, and new introductions, and experiments with different dates and rates of seeding conducted at the Northern Great Plains Substation, Mandan, N. Dak., from 1914 to 1916 are reported. In addition to presenting considerable tabulated agronomic and chemical data showing the differences in the varieties and strains, the author reviews the use of flax as a sod crop, outlines the present flax area, and includes a brief history of the substation with notes on its environs and climate.

In interpreting the experimental results, the author asserts that while yield of seed is the predominating factor in the value of a variety or cultural method when flax is grown for seed alone, other factors such as earliness of maturity, a definite period of bloom, erectness of straw, yield and quality of oil, and distinctive characters of flower or seed, are worthy of consideration. The continuation of growing of certain types and varieties can be justified only on the basis of classification studies and their utilization in hybridization. Conclusions and recommendations based on the results obtained may be summarized as follows:

European seed-flax varieties have proved superior to others for the conditions in the semiarid sections of the North-Central States. The true seed types rather than the short-fiber types were found most productive, and the Reserve (C. I. No. 19), Damont (C. I. No. 3), Frontier (C. I. No. 17), and North Dakota Resistant No. 52 varieties, which yielded highest in the experiments at Mandan, are the best known and most widely distributed varieties in this group.

While North Dakota Resistant No. 114 was one of the two varieties significantly low in yield in this experiment, it was the only variety possessing superior resistance to flax wilt (*Fusarium lini*). It is not thought to be particularly adapted to semiarid conditions, but is recommended for the more humid sections of the Dakotas and Minnesota where flax is grown in rotation with other crops on old land.

The nursery experiments indicated that acclimated seed, particularly of selected domestic strains, was more desirable than new importations. Russian and northern European strains selected toward a high seed-producing type are deemed best adapted for semiarid conditions in the Northwest. Commercial growers are not advised to risk large acreages with Argentine seed, and the author declares that the growing of Indian, Abyssinian, or south European seed in this area can only result in total failure.

With thorough preparation of the land and a good seed bed, 20 lbs. of flax to the acre seems to be a sufficiently heavy rate of seeding. Although heavier seeding may be preferable under certain conditions, such as a seed bed so dry that germination is uncertain, the results obtained do not indicate much advantage and the high price of seed flax discourages the practice.

Early seeding is recommended on breaking, the land not being left to dry out after the seed bed is prepared. It is held desirable to follow the plow, disk harrow, or packer immediately with the drill if breaking is done in the spring, while land backset the previous fall should be disked before seeding in order to kill weed growth and improve the seed bed. The best results can be expected from seedings made from May 1 to June 10, with a rapid decrease in yield from sowings made after the latter date.

Lespedeza as a forage crop, L. Carrier and H. S. Coe (*U. S. Dept. Agr., Farmers' Bul. 1143* (*1920*), *pp. 15, figs. 5*).—An account of the environmental adaptations, methods of production, and uses of lespedeza (*L. striata*), with brief instructions for seed harvesting. Lespedeza, or Japan clover, is considered one of the most valuable forage plants for the southeastern part of the United States, producing good results in pastures, meadow mixtures and rotations, and as a soil-improving crop.

Fall-sown oats, C. W. Warburton and T. R. Stanton (*U. S. Dept. Agr., Farmers' Bul. 1119* (*1920*), *pp. 21, figs. 9*).—This publication comprises a discussion of the soil, climatic and varietal adaptations of the crop, and the field practices and cultural methods employed in its production. Fall-sown oats are especially recommended for the South, as they provide a winter cover for the land, preventing washing and leaching; provide winter pasture, grain, and forage for work stock; and may be grown to advantage in rotation with corn and cotton.

Peanut growing for profit, W. R. Beattie (*U. S. Dept. Agr., Farmers' Bul. 1127* (*1920*), *pp. 33, figs. 20*).—This publication presents a rather detailed account of the climatic and soil adaptations, methods of production, and preparation for the market of the peanut, together with short descriptions of the more important commercial varieties and notes on the uses of the crop and its by-products as stock food. The value of the peanut as a money crop and cooperation among growers are briefly discussed.

Line selection work with potatoes, O. B. Whipple (*Jour. Agr. Research* [*U. S.*], *19* (*1920*), *No. 11, pp. 543–573*).—This contribution from the Montana Experiment Station describes work in the improvement of existing potato varieties through tuber selection. The results of three seasons' work with 108 Green Mountain, 108 Rural New Yorker, and 100 Early Six Weeks selections are presented "for the purpose of calling attention to the difficulty of interpreting these performance records." Considerable data are included in tabular form, and the ranking of high and low yielding strains discussed.

The author did not find that the data presented very strong evidence of the presence of high yielding strains within the common population of the varieties studied, but held that the real test of the existence of such lines is the ability to maintain a high yielding progeny. With but few exceptions high yielding lines were not consistent high yielders; neither were all low yielding lines consistent low yielders.

Short performance records are deemed fairly reliable in eliminating lines with low yielding tendencies but not so reliable as a basis for selecting plus variations if existing. Where degenerate tendencies exist within certain clonal lines and not in others, short performance records are considered of slight value in eliminating the undesirable lines. The persistent regularity of appearance of degenerate individuals within line selections is considered to be a serious impediment. Yield records do not promise to be very effective in dealing with degeneracy. Although those lines which have appeared frequently among the lowest yielding are typical degenerates, degenerate tendencies are noticeable among the high yielding ones.

The data showed a lack of correlation between yields in numbers of tubers and in weight. Although a rather pronounced variation was noted between the average of the 20 highest and 20 lowest of 108 Rural New Yorker tuber lines when ranked on three years' average numerical tuber production per hill, the data were apparently no more reliable than weight records in pointing out promising lines. Low numerical tuber production does not always mean low production by weight, and such records are apparently of little value as a check on degenerate tendencies. Fluctuation in tuber production in different seasons has been even greater than the variation between lines in any one season.

Hill selection is not valued as a practical method of improvement, as the data indicate that it brings only temporary increases in yield, and that such selection does not isolate high yielding lines which may be maintained as high yielding population by mass selection based on tuber characteristics alone.

In outlining a method of potato seed improvement based on vine characteristics, the author states that since these characteristics are so closely correlated with yields, selection based on vine development alone promises to be more reliable than selection based on tuber production either by weight or number, and to be much more practical.

Effect of wounds on loss of weight of potatoes, O. Butler (*New Hampshire Sta. Sci. Contrib. 15* (*1919*), *pp. 304, 305*).—This has been noted previously (E. S. R., 42, p. 137).

The amount of salt in irrigation water injurious to rice, F. C. Quereau (*Louisiana Stas. Bul. 171* (*1920*), *pp. 3–14, figs. 8*).—Water containing 35 grains or more of salt per gallon produced a decidedly deleterious effect on rice where used for one or two floodings in pot tests. With the smaller amounts of salt, 35 to 50 grains per gallon, the grains were light and twisted in many cases and the kernels soft and chalky. The continued use of the smaller amounts resulted in the death of the plants. Where water with more than 50 grains per gallon was used, the plants all died after a short period of growth.

In tests conducted by Paschke and Hoffpauir, field plats irrigated with water containing 25, 35, 50, and 75 grains of salt per gallon received 4 224, 6,600, 9,427, and 14,080 lbs. respectively, of salt per acre and made respective acre yields of 3,049, 2,450, 1,524, and 1,143 lbs. of rice. Where the amount of salt per gallon of water was 35 grains or more, the quality of the grain was affected adversely as in the pot experiments.

The author does not consider the use of water containing more than 35 grains of salt per gallon in a flooding of from 4 to 8 in. advisable, if the salt water is to remain on the field until evaporated or diluted with fresh water. Water containing more than 15 grains of salt per gallon should not be used for a second flooding.

United States grades for milled rice (*U. S. Dept. Agr., Dept. Circ. 133 (1920), pp. 16*).—This circular defines the grades and classes recommended by this Department for grading and marketing milled rice.

Grain sorghums: How to grow them, B. E. ROTHGEB (*U. S. Dept. Agr., Farmers' Bul. 1137 (1920), pp. 26. figs. 15*).—This publication presents descriptions of the more important varieties of grain sorghums, discusses the principal means of increasing the yield and quality of the grain, and describes the cultural methods and field practices regarded best in growing the crops. Brief notes on storage of thrashed grain are included, and the construction of a simple ventilator for use in farm bins is illustrated and described.

Dwarf and early varieties in both the kafir and milo-durra groups are considered best for the higher and drier districts. The milos, ripening in 90 to 110 days, are adapted to short seasons, high elevations, and low rainfall, while the kafirs, maturing later and requiring more moisture, thrive best when the rainfall is about 25 in. and the elevation ranges up to about 2,000 or 2,500 ft.

Australian wheat varieties in the Pacific coast area, J. A. CLARK, D. E. STEPHENS, and V. H. FLORELL (*U. S. Dept. Agr. Bul. 877 (1920), pp. 25, pls. 3*).—Experiments with Australian wheat varieites at Moro, Oreg., and Chico, Calif., including nursery and plat tests, water requirement studies, and comparisons with commercial varieties are reported, together with a brief account of the introductions of Australian wheat and descriptions of the more important varieties. Descriptive data and results of milling and baking tests of Australian and other varieties are tabulated and discussed. The results of the investigations can be summarized as follows:

The White Australian and Pacific Bluestem varieties of Australian wheat were long since found adapted to the Pacific coast area of the United States, but have been replaced in many sections recently by Early Baart, an earlier maturing, more drought resisting, higher yielding, and better milling Australian wheat.

Preliminary nursery experiments with about 130 lots of Australian wheats recently introduced gave striking indications that Federation, Hard Federation, and White Federation are probably the best adapted of all varieties in two sections of the Pacific coast area. These have been compared with the leading commercial varieties of spring wheat for two years and have produced higher yields. Hard Federation produced the larger yields in Oregon, while White Federation outyielded it in California. One cause for the higher yield of Hard Federation over Early Baart was shown to be a lower water requirement in proportion to the grain produced.

Experiments disclosed that Hard Federation is superior for milling and breadmaking purposes to the leading commercial varieties now grown in the Pacific coast area and also to Federation and White Federation wheats.

Observations indicate that Australian varieties in general are susceptible to most cereal diseases, but as many of these are not destructive in the Pacific coast area, this is not considered a sufficient reason for not increasing their production.

HORTICULTURE.

Methodical catalogue of the cultivated plants (species and varieties) of Spain, and of the principal ligneous species, J. D. Cereceda (*Catálogo Metódico de las Plantas Cultivadas (Especies y Variedades) en España y de las Principales Especies Arbóreas (Madrid: Min. Fomento Serv. Pub. Agr., 1920, pp. 62, figs. 22)*).—The first part of this catalogue comprises a descriptive list of the cultivated herbaceous plants. Part 2 contains lists of fruit trees and economically important forest trees of Spain.

[Report of the] Botanic Gardens, Georgetown, R. Ward (*Brit. Guiana Dept. Sci. and Agr. Rpt., 1918, pp. 47–51*).—In addition to a report on routine operations, lists are given of trees and orchids which flowered during 1918, with the months of their flowering. Several palms and miscellaneous plants flowering during the year are also listed, and a record is given of the number of fruits borne by different varieties of mangoes.

Trees and shrubs of Mexico, P. C. Standley (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium, 23 (1920), pt. 1, pp. 182+XVIII*).—A descriptive list of the trees and shrubs of Mexico, based primarily upon the collections in the United States National Herbarium, although the published species not represented there have been included in the keys when possible.

[Report on the condition of trees at the Dickinson Substation in 1919], L. Moomaw (*North Dakota Sta. Bul. 138 (1920), pp. 24, figs. 2*).—A brief note on the condition of forest and fruit tree plantings.

Of a large variety of fruit trees planted during previous years a number of Siberian crabs are all that remained alive. A few of these have produced fruit of good size and excellent flavor, but most of them bear a small fruit too bitter and astringent for any use except jellies, etc.

Law and regulations concerning plant quarantine service in Japan (*Japan: Imp. Plant Quarantine Sta., Dept. Agr. and Com., 1919, pp. 25, figs. 9*).—The full text is given of the plant quarantine law promulgated on March 25, 1914, together with the regulations under this law and the rules regulating the plant quarantine station.

Plant propagating pots of peat, W. Freckmann and C. Strohbücker (*Mitt. Ver. Ford. Moorkult. Deut. Reiche, 38 (1920), No. 16, pp. 289–293, figs. 4*).—In this note the authors report the successful use of pots made from peat in propagating tomatoes, cucumbers, cauliflower, and other vegetables.

[Dwarf French beans and lettuces at Wisley, 1919] (*Jour. Roy. Hort. Soc., 45 (1920), No. 2–3, pp. 316–353*).—A report, with varietal descriptions, of a large number of stocks of French beans and lettuces tested at Wisley in 1919.

Winter lettuces at Wisley, 1917–18 (*Jour. Roy. Hort. Soc., 45 (1920), No. 2–3, pp. 354–359*).—A report on variety tests on winter lettuce conducted at Wisley in 1917–18.

[Comparative test of tomatoes] (*Rhode Island Sta. Rpt. 1919, p. 10*).—In a comparative test for earliness the Earliana tomato proved to be earlier than any of four strains of Bonny Best tested. All the plants were set out May 21. The first two pickings, which were made on July 24 and 31, yielded 70 per cent more of Earliana than of Bonny Best. Langdon Campbell strain of Bonny Best was the earliest of the four strains, and on August 21 it had produced three-fourths as much as Earliana. The total yield of Earliana was at the rate

of 1,008 bu. per acre, and of Bonny Best at the rate of 934 bu. The fruit of Bonny Best proved to be smoother and much superior in appearance.

Practical hardy fruit culture, R. Staward (*London: Swarthmore Press, Ltd., 1920, pp. 216, pls. 18, figs. 8*).—A practical treatise on the culture of orchard and small fruits and nuts, with special reference to English conditions. The instructions contained in the book are based upon the author's practical experience extending over a period of 37 years.

The Laurel experiments, J. Oskamp (*Hoosier Hort., 2 (1920), No. 9, pp. 3–11*).—A discussion of the results secured for a ten-year period from various systems of orchard management in the experiments being conducted by the Indiana Station at Laurel. This work was also summarized in a recent report of the station (E. S. R., 43, p. 337).

A thirty-five years' record of fruit from a grass orchard, C. H. Hooper (*Fruit, Flower, and Veg. Trades' Jour. [London], 38 (1920), Nos. 8, p. 210; 9, p. 229*).—A summarized record of the yield of fruit and money return for 35 years from a grass orchard at Sheldwich, near Faversham, Kent, is given and discussed.

Address [on orchard fertilization], W. H. Alderman (*Hoosier Hort., 11 (1920), No. 10, pp. 3–10*).—A contribution from the University of Minnesota comprising a popular review of experiment station results dealing with orchard fertilization.

Off-year apple bearing and apple spur growth, R. H. Roberts (*Wisconsin Sta. Bul. 317 (1920), pp. 34, figs. 16*).—A discussion of the factors influencing biennial bearing in apples, and of the development and functioning of apple spurs, including suggestions as to the specific use of various cultural practices in regulating bearing. The discussion is based upon observations and studies of alternate bearing orchards in Wisconsin for the last five seasons and upon related studies by other investigators.

From the study as a whole the author concludes that biennial bearing appears to be related to nutritional conditions. Under average conditions of nutrition the production of blossoms and the setting of fruit in the fruiting year greatly limits the fruit spur growth of that year. The result is a sort of biennial growth cycle that occurs with a regularity which has caused the off year to be considered generally as a fixed tree character.

Biennial-bearing trees show different growth conditions from annual-bearing trees. In Wisconsin the usual terminal growth made by the average old, biennial-bearing Wealthy tree is only about 4 to 5 in. The spur growth is also reduced in length, and in the off year the majority of the spurs developed are of the medium length class (about 0.5 in.) most of which blossom and many of which set fruit the following year. The heavy blossoming in the fruiting year apparently makes a serious drain on the usual low nitrate content of the soil at that time of year, with a resulting development of spurs that are too short in length to fruit or even blossom the next year. The blossom buds form nearly a year before blossoming.

Annual-bearing trees usually have a terminal growth of 12 to 16 in. or more. The resulting spur growth is more irregular in length, but includes both non-blossoming, blossoming, fruiting, and overvigorous spurs, and thus some spurs alternating in bearing. Furthermore, there is a "normal" fruit spur formation on second-year wood, and with some varieties the formation of terminal and lateral blossom buds. The total result is regular annual blossoming of the tree as a whole.

In some small experimental pruning tests, pruning by small cuts in the off year, thus reducing total blossom bud formation, resulted in promoting regular bearing on what were formerly persistent off-year trees. Removal of the

blossoms before the fruit sets has resulted in successive blooming, but with the Wealthy variety the removal of all the young fruits any time after they have set fails to give successive bearing. Removal of the leaves has stopped blossom bud formation. Following the freeze of 1910 the on year changed from the even- to the odd-numbered year. This phenomenon occurred with all varieties.

The author points out in substance that cultural practices undertaken to promote regular bearing should be based upon the kind and amount of the spur growth which the individual tree makes. In some cases cultivation may be necessary; in others the application, early in the season, of a readily available nitrogenous fertilizer; and in others pruning, especially by small cuts throughout the tree rather than by the removal of large limbs. Sufficient pruning should be done to admit light to the lower wood if the spurs are to be kept fruitful.

Suggestions for the right selection of apple stocks, R. G. Hatton (*Jour. Roy. Hort. Soc*, *45* (*1920*), *No. 2–3*, *pp. 257–268*, *pls. 16*).—A contribution from the Wye College Fruit Experiment Station, discussing the practical results to date of experiments with apple stocks being conducted both at Bristol and at East Malling.

The work thus far conducted shows that there is a wide range of root systems in all stocks tested, including free, crab, and Paradise. Root conditions become apparent at an early stage in the life of the seedling stocks. Both free and Paradise stocks contain dwarfing and free-growing types which are capable of vegetative propagation. In lieu of further experimentation, the author recommends that an attempt be made to standardize free stocks by grading the seedling stocks at the time of planting out and further deroguing the free-stock beds of obvious weaklings before the bedding and grafting season. Another method recommended is to select from among the stronger types of so-called Paradise stocks such as by their free rooting and growth habit and deep anchorage appear identical with free stocks. Any of these types, it is stated, can be raised quickly by layers, wood and root cuttings, and could be used for standard purposes with comparative safety. As a quick method of increasing the supply of nursery stocks in the present emergency, the author also advocates the reproduction of the most promising sorts from root cuttings.

A first report on quince stocks for pears, R. G. Hatton (*Jour. Roy Hort. Soc.*, *45* (*1920*), *No. 2–3*, *pp. 269–277*, *pls. 7*).—A contribution from the Wye College Fruit Experiment Station, comprising a summary of the different forms of quince commercially used as dwarfing stocks for pears at the present time. The author notes that although the quince is used almost exclusively in dwarfing pears, trees worked upon the white thorn (*Crataegus oxyacantha*) and upon the mountain ash (*Pyrus aucuparia*) are occasionally to be found.

Investigations in the ripening and storage of Bartlett pears, J. R. Magness (*Jour. Agr. Research* [*U. S.*], *19* (*1920*), *No. 10*, *pp 473–500*, *figs. 8*).—A contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, giving the results of chemical changes taking place in Bartlett pears from the different Pacific coast regions during the time they are developing and between the time they are picked from the tree and the time the fruit is in prime eating condition. The results are presented in tabular form and discussed, and related investigations are reviewed.

"There is a marked and quite uniform increase in total sugar in Bartlett pears from early summer until after the time of the close of the commercial picking season. The increase during the latter part of the season is mainly due to an accumulation of sucrose, while the earlier increase is due mainly to

reducing sugar. A distinct relationship was found between the total amount of sugar present in the ripe fruit and the temperature of the storage at which it had been held from the time of removing from the tree until ripe. Pears ripened at 70° F. contained the highest percentage of sugar, those ripened at 40° possessed the lowest total sugar content, and those held at 30° for from 6 to 14 weeks and then ripened at room temperature were intermediate in amount of total sugar. There was no marked relation between temperature of storage and relative amount of sucrose and reducing sugar.

"Percentage of titratable acid in the fruit tended to decrease in fruit from the California sections as the season advanced, while it tended to increase in that from Oregon and Washington. There was an increase in acid between the time of picking and the time of full ripening of the fruit when held at 70° F. There was much less acid in fruit ripened at 40° than in that ripened at 70°, and still less in fruit that had been held at 30°. The acid content of the fruit that was allowed to become well matured on the tree remained nearly constant during storage.

"There was a progressive reduction in the alcohol-insoluble, acid-hydrolyzable reducing material as the season advanced, not only in the fruit fresh picked from the tree, but also in the same fruit after ripening. There is a marked reduction in these substances between the time when the fruit is first picked and the time when the same fruit becomes ripe. The percentage of total solids is lowest at about the opening of the commercial season. This tends to increase with the accumulation of sugar in the late-picked lots.

"With proper precautions of picking, handling, and storing, Bartlett pears can be held two to three months in storage and then taken out in good condition."

A general discussion of the results as applied to commercial handling is also given.

Annular incision of peaches, L. AUBIN (*Prog. Agr. et Vitic. (Ed. l'Est-Centre), 41 (1920), No. 41, pp. 356, 357*).—Ringing experiments conducted with two varieties of peaches, the Amsden and the Hale Early, resulted in hastening the maturity of the fruit of the former variety about 13 days and of the latter variety about 22 days. The weight of the fruit was also increased somewhat. In the case of the Hale Early variety about 15 per cent of the fruit maturing on the ringed branches was imperfect, with split stones. This defect was not noticeable with the fruit of the Amsden variety.

Berry growing in western Washington, J. L. STAHL (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 6, pp. 82–85*).—Concise directions are given for growing blackberries, loganberries, raspberries, and strawberries, including a varietal list for western Washington.

On the method of distributing plant food in the vineyard, L. DEGRULLY (*Prog. Agr. et Vitic., (Ed. l'Est-Centre), 41 (1920), No. 42, pp. 365–368, figs. 2*).—This note describes a method of fertilizing grapevines that is used in Algeria. The method consists in digging holes from 12 to 14 in. square and deep in every other row opposite the vines. These holes are filled with manure and supplementary fertilizers, and a mass of fibrous roots is developed at this point. In the following year holes are dug in the alternate rows. The holes are replenished with new manure every other year, and the spent manure is worked into the soil about the vines. The root pruning accompanying this operation further stimulates the growth of fibrous roots.

Grafted vineyards, P. J. CILLIE, A. I. PEROLD, and S. W. VAN NIEKERK (*Union So. Africa, Dept. Agr. Jour., 1 (1920), No. 6, pp. 561–569*).—This comprises a report of a commission appointed by the South African Department of Agriculture to determine the present status of vineyards grafted on American stocks. A list is given of varieties which are recommended or condemned.

Report of the horticultural division, J. E. Higgins (*Hawaii Sta. Rpt. 1919, pp. 16–22, 23–40, pls. 4*).—This comprises a survey of work being conducted, or about to be conducted, with various horticultural crops, including the Macadamia nut, avocado, mango, papaya, litchi, coffee, vanilla, pineapple, algaroba, and some miscellaneous plants, together with a brief review of horticultural extension work.

Descriptive accounts are given of the Beardsley avocado, a new variety of the Guatemalan type of Hawaiian origin; the Solo papaya, which has transmitted its desirable qualities of texture and flavor through four generations and is considered one of the best of the papayas that have grown at the station; and of several varieties of mangoes which seem best adapted to local cultivation, or which are of most interest from the standpoint of breeding.

The system now commonly used in coffee growing in Hawaii, together with the process of preparing it for market, is briefly described. In this connection data are given showing approximate amount of coffee produced and the amount of waste products that might be available for the manufacture of caffein.

Citrus fruit growing in the Gulf States, E. D. Vosbury (*U. S. Dept. Agr., Farmers' Bul. 1122 (1920), pp. 46, figs. 12*).—A brief account is given of the history and development of the citrus industry in Florida and the other Gulf State citrus regions, together with a discussion of the factors involved in the choice of locality and site, the selection of varieties and cultural methods, the business aspects of the industry, and other important problems A list is included of Departmental publications relating to various phases of citrus culture.

Citranges, limonanges, satsumanges, A. Guillaumin (*Rev. Hort. [Paris], 92 (1920), Nos. 8, pp. 140–142, figs. 2; 9, pp. 157–159, fig. 1*).—This note consists essentially of an enumeration of the hybrids between *Citrus* (*Poncirus*) *trifoliata* and different citrus species resulting from the work of Bernard, Webber, and Swingle.

Fertilizer experiments with pineapples, M O. Johnson and K. A. Ching (*Hawaii Sta. Rpt. 1919. p 43*).—In some fertilizer experiments with pineapples various mixtures of the more insoluble fertilizers were applied directly to the heart of the plants. Dried blood applied in this manner gave the best results, yielding a fine stand of fruit, superior to the check rows on either side. Fish scrap applied in the same manner produced very dark green healthy plants. An application of fish scrap made at the time some of the plants were budding, however, resulted in more or less distorted or injured fruit. Steamed bone meal produced small but positive benefit.

Cobnuts and filberts, E. A. Bunyard (*Jour. Roy. Hort. Soc., 45 (1920), No. 2–3, pp. 224–232, pls. 4*).—A brief discussion on the history, culture, and diseases of cobnuts and filberts, including a descriptive list of the more important varieties.

The camphor tree and its products, E. Perrot and V. Gatin (*Min. Com. et Indus., Off. Natl. Matières Veg., Not. 4 (1920), pp. 60, figs. 9*).—A compilation of information on the camphor tree and its products, including a bibliography of related literature.

Effect of pollination on the life of flowers, W. H. Phipps (*Flower Grower, 7 (1920), No. 11, p. 182*).—The author's experience and observation has shown that when flowers have been pollinized, either artificially or by natural agencies such as bees and other honey-seeking insects, they wither and decay much sooner than the flowers that are not pollinized. Varieties that seldom bear seed last longer as cut flowers than fertile varieties. Removing the pistils from fertile varieties before pollination takes place will prolong the life of the flowers.

The structure of the canna flower, J. C. Costerus (*Rec. Trav. Bot. Néerland., 17 (1920), No. 1-2, pp. 26-32, pl. 1*).—A note on the structure of the canna flower, with special reference to the coupler ("l'accoupleur"), the name by which the author designates the staminode that connects the style to the stamen; the syndrome of the flowers; and the morphologic value of the style.

Mendelian characters in bearded irises, A. J. Bliss (*Jour. Roy. Hort. Soc., 45 (1920), No. 2-3, pp. 289-292*).—Data are given on character transmission in a number of iris seedlings resulting from crosses made in 1906.

Pansies and violas, H. H. Thomas (*London and New York: Cassell & Co., Ltd., 1920, pp. 80, figs. 24*).—A small cultural treatise, including information relative to select varieties and the control of pests and diseases.

Roses: Their history, development, and cultivation, J. H. Pemberton (*London and New York: Longmans, Green & Co., 1920, 2. ed., pp. XXIV+334, pls. 10, figs. 32*).—This is a second, revised, and somewhat enlarged edition of this work (E. S. R., 20, p. 241). Part 1 discusses the importance of the rose in English history, its botany, the wild rose of Britain and other countries, summer flowering roses, and autumn flowering roses. Part 2 deals with the propagation, culture, and care of roses, both under glass and in the open. Appended to the work is a descriptive list of select roses recommended for cultivation, including the method of pruning.

How to grow roses, R. Pyle (*West Grove, Pa.: Conard & Jones Co., 1920, 13. ed., rev. and enl., pp. 121, figs. 92*).—A treatise on amateur rose growing, containing also considerable information on varieties for various purposes, uses, and sections of the United States; a rose bibliography; a list of synonymous roses; analysis of species; and arrangement of roses in classes. Concise information relative to the American Rose Society, and the making of rose beads and attar of roses is also included.

Raising new roses from seed, W. Van Fleet (*Gard. Mag. [New York], 31 (1920), No. 6, pp. 370-373, figs. 6*).—A popular descriptive account of the author's work in breeding and raising roses at the Bell Experiment Plat of the U. S. Department of Agriculture at Glenn Dale, Md.

Essence plants, with special reference to the rose and jasmine in southern France, L. Daniel and Meunissier (*Min. Com. et Indus., Off. Natl. Matières Vég., Not. 3 (1920), pp. 16*).—A brief report on a survey of the essence industry in southern France, with special reference to the production of rose and jasmine perfumes.

Lavender, A. Humbert (*Min. Com. et Indus., Off. Natl. Matières Vég., Not. 1 (1919), pp. 22*).—This comprises the results of a survey of the lavender industry in France, including information relative to regions of protection, cultural requirements, varieties, propagation, and methods of distillation and exploitation.

Native plants suitable for the gardens of Missouri and adjoining States.—VIII, Native shrubs for mass planting, flowers inconspicuous.—IX, Native trees and shrubs with bright colored foliage in autumn and conspicuous fruit and bark in autumn and winter.—X, Native evergreen trees and shrubs (*Missouri Bot. Gard. Bul., 8 (1920), No. 8, pp. 104-110*).—A contribution from the Missouri Botanical Garden continuing previous lists of native plants (E. S. R., p. 838).

FORESTRY.

North American forest research, E. H. Clapp et al. (*Bul. Natl. Research Council, 1 (1920), No. 4, pp. 155-300*).—This comprises a list of investigative projects in forestry and allied subjects conducted by National, State, and Provincial Governments, schools of forestry, scientific schools, and private interests in

Canada, Newfoundland, and the United States for 1919–20. This information was compiled by the committee on American forest research of the Society of American Foresters.

Annual report of the Minnesota State Forestry Board, M. M. WILLIAMS ET AL. (*Minn. State Forestry Bd. Ann. Rpt., 1919, pp. 16, fig. 1*).—A report on routine operations, including fire protective work during 1918–19, with recommendations for needed legislation.

Annual progress report on forest administration in the Presidency of Bengal for the year 1917–18, H. A. FARRINGTON (*Bengal Forest Admin. Ann. Rpt., 1917–18, pp. [55]*).—The usual progress report for the year 1917–18 on the administration and management of the State forests in Bengal, with appended data relative to alterations in forest areas, forest surveys, working plans, protection, grazing, silvicultural operations, yields in major and minor forest products, revenues, expenditures, etc.

Progress report of forest administration in Baluchistan for 1918–19, F. W. JOHNSTON (*Baluchistan Forest Admin. Rpt., 1918–19, pp. [26]*).—A report similar to the above on the State forests in Baluchistan for the year 1918–19.

Annual progress report upon State forest administration in South Australia for the year ended June 30, 1919, W. GILL (*So. Aust. State Forest Admin. Ann. Rpt., 1918–19, pp. 12, pls. 10*).—This is the usual progress report relative to the administration and management of the State forests in South Australia, including data relative to alterations in forest areas, planting and other operations, revenues, expenditures, etc. Plans of several forest plantations are appended.

Stereophotogrammetry and its importance in forestry, H. DOCK (*Centbl. Gesam. Forstw., 46 (1920), No. 3–4, pp. 65–90, figs. 8*).—The author describes and illustrates the use of the phototheodolite, the stereocomparator, and the stereoautograph in making forest surveys.

Critical considerations on the theory of financial rotation and forest income, W. ROTHKEGEL (*Ztschr. Forst. u. Jagdw., 52 (1920), No. 8, pp. 457–477*).—A discussion of the principles underlying the determination of net revenues and the yield values in forestry.

Factors controlling the distribution of forest types, I, G. A. PEARSON (*Ecology, 1 (1920), No. 3, pp 139–159, figs. 8*).—A preliminary report on a study that has been in progress at the Fort Valley Experiment Station of the Forest Service, U. S. Department of Agriculture, in the San Francisco Mountains in Arizona during the past two years. The object of the study has been to correlate the occurrence of tree species with physical environment in different forest types or associations, and thus to determine what conditions are favorable and what unfavorable to each species. The present paper deals with the physical characteristics of the forest types under observation, as well as the existing temperature, precipitation, wind, evaporation, and soil conditions.

The artificial production of vigorous trees by hybridization, A. HENRY (*Quart. Jour. Forestry, 14 (1920), No. 4, pp. 253–257*).—A brief review of literature dealing with hybridization of forest trees.

Forests in the sand hills, F. R. JOHNSON (*Amer. Forestry, 26 (1920), No. 322, pp. 582–584, figs. 4*).—A popular account of the work of the Forest Service, U. S. Department of Agriculture, in planting trees in sand hill regions of western Nebraska.

Use, propagation, and culture of eucalyptus, and the planting of nursery belts, P. A. BOVET (*Buenos Aires Min. Obras Pub., Chacra Expt. Patagónes [Fol. 6], (1920), pp. 154, pls. 4, figs. 149*).—This pamphlet discusses the use, propagation, and culture of eucalyptus, including the planting of eucalyptus in parks, shelter belts, and for timber, with special reference to conditions in

Patagonia. Descriptive notes are given of the more important varieties. A map is included in which the country is divided into zones showing the probable region of culture of some of the more important species.

The green Douglas fir (Pseudotsuga douglassi) in the Vienna forest, A. CIESLAR (*Centbl. Gesam. Forstw., 46 (1920), No. 1-2, pp. 3-26*).—A discussion of the economic value of the Douglas fir, including growth and yield data. The author concludes that the Douglas fir is well adapted to Austrian conditions both from the aesthetic and economic viewpoints.

Raising white pine in Minnesota, P. O. ANDERSON and A. F. OPPEL (*Minn. Forest Serv. Bul. 5 (1920), pp. 32, figs. 19*).—This bulletin discusses the importance of the white pine in Minnesota, and gives information relative to methods of establishing, managing and safeguarding, and growing white pine forests so that the best possible returns may be realized.

Practical experiences with Hevea brasiliensis on gray soil, G. DEVRAIGNE (*Bul. Écon. Indochine, n. ser., 23 (1920), No. 142, pp. 375-405, pls. 7, figs. 15*).—A progress report for the three seasons 1917-1919 on planting and tapping experiments with Hevea rubber trees that are being conducted at the Agricultural Experiment Station, Bencat, Cochin China, together with an outline of the work as it is to be continued. The data presented deal with the results of different planting methods, alternate day and daily tapping, and of different methods of tapping.

Some notes about the forest resources of the State, with illustrations and map of main forest region (*Perth: West. Aust. Forests Dept., 1919, pp. 22, pl. 1, figs. 9*).—Descriptive notes are given on the forests and the important forest trees of Western Australia.

Short descriptive notes of the principal timbers of Western Australia, R. T. ROBINSON (*Perth: West. Aust. Dept. Woods and Forests, 1919, pp. 8*).—Information is given on several species relative to the average size of the timber, weight per cubic foot, transverse and tensile strength, distinguishing characteristics, and use.

A guide to the identification of our more useful timbers, H. STONE (*Cambridge: Univ. Press, 1920, pp. 52, pls. 3*).—A small manual prepared for the use of students of forestry, and comprising descriptions of transverse, radial, and tangential sections of the woods of a large number of broad leaved and coniferous trees.

DISEASES OF PLANTS.

Report of the division of plant pathology, C. W. CARPENTER (*Hawaii Sta. Rpt. 1919, pp. 49-53, 53, 54, pl. 1*).—A report is given of the work carried on during the year, investigations on taro rot and spraying experiments for the control of the banana freckle disease being the principal studies.

A preliminary study of the taro rot showed several forms of this disease present in Hawaii, the most common and destructive type being characterized by grayish or brownish rot of the taro corm. Cultures studies of this rot showed the presence of an organism which resembles *Pythium debaryanum*, and the author believes that this species of fungus or one nearly related to it is the cause of the common form of taro rot.

In addition to the above, *Sclerotium rolfsii* was found associated with a rot of taro several days after the crop was harvested. The causes of this disease as well as means for its control are being investigated further.

In the experiments for the control of banana freckle disease (*Phoma musæ*), the author found that pruning and spraying resulted in a greatly diminished amount of disease. Preliminary experiments showed that Bordeaux mixture

would not spread well on waxy banana leaves, but experiments with a resin sal soda sticker proved that when added to Bordeaux mixture it spread well and adhered to the foliage. For the preparation of this adhesive, the author recommends the boiling of 4 lbs. of resin and 2.5 lbs. of sal soda in 2 gal. of water, 2 qts. of this solution to be used with each 50 gal. of Bordeaux mixture.

Brief notes are given on miscellaneous plant diseases observed during the year.

Report on plant disease conditions in Ohio for 1918, A. D. Selby (*Ohio State Hort. Soc. Ann. Rpt. 52 (1919), pp. 28–31*).—This report deals with general conditions during the year; with winter injury as due largely to lack of maturity of growth, to immaturity of leaf and blossom buds, and to spring frost; and with midsummer conditions of high temperature followed by a very dry period. The various diseases dealt with are listed, and notes are given on differences as regards the effects of spraying.

Injurious fungi of Ste. Anne de Bellevue, 1917, P. I. Bryce (*Quebec Soc. Protect. Plants [etc.], Ann. Rpt., 10 (1917–18), pp. 49–51*).—The weather during the growing season is considered to have favored several diseases not ordinarily notable as regards injury. Mention is made of alfalfa leaf spot; apple black rot; apple and plum bracket fungus (*Schizophyllum* sp.); apple scab and leaf brown spot (later dropping out); wheat black rust (cluster cups on other hosts); bean (*Phaseolus vulgaris*) bacterial blight and anthracnose ("rust"); beet leaf blight and storage injury (*Sclerotinia* sp.); red clover anthracnose; maize smut; red currant leaf spot (anthracnose); black currant (European) rust and leaf spot (Septoria); grape downy mildew; hollyhock rust; silver maple leaf blotch (tar spot); orchard grass mildew; pear scab (spot); red root pigweed white rust (Cystopus); lamb's quarters downy mildew; plum leaf spot (shothole) and brown rot; potato early and late blight, Fusarium dry rot, and rose rust; rye ergot; soy bean bacterial blight; and tomato blossom end rot and leaf spot (*Septoria* sp.).

Abstracts of Canadian plant disease literature, edited by W. A. McCubbin (*Quebec Soc. Protect Plants [etc.], Ann. Rpt., 11 (1918–19), pp 72–83*).—The abstracts given in this list are said to cover all the Canadian literature on plant diseases up to January 1, 1919, which has been published in Canadian bulletins or periodicals. This list includes about 222 titles.

Plant pathology.—Report of the committee upon the necessity for further provision for the organization of research in plant pathology in the British Empire, M. C. Potter et al. (*Brit. Assoc. Adv. Sci. Rpt., 1918, pp. 56–58*).—This committee, appointed in July, 1917, here reports upon conditions in Great Britain, concluding that the present opportunities for training, research, and correlation in plant pathology are inadequate. Desirable developments are indicated in some detail.

Cryptogamic review for 1916, G. Briosi (*Atti R. Ist. Bot. Univ. Pavia, 2. ser., 17 (1920), pp. 81–101*).—This report gives in the usual form (E. S. R., 38, p. 351) information regarding cereal, orchard, and other agricultural interests as related to plant diseases and as affected by war conditions.

[Report on plant diseases], E. A. Mann (*West. Aust. Govt. Anal. Ann. Rpt. 1919, p. 8*).—In this portion of the report of the analyst, it is claimed that plant pathology in Western Australia differs considerably from that in the eastern portion, a larger percentage of the plant disease in west Australia being physiological. This is said to be due largely to irregularity in nutrition. The long, dry summers and wet winters, with accompanying fluctuations of the water table, cause alternate deep and surface rooting. Introduced plants suffer more than native plants in this regard. The result of these conditions is made apparent in the development of orange exanthema, and of die-back with sour

sap and drought in such other plants as apple, pear, cherry, and peach, the same principle underlying the manifestations of disease in all these fruits. Even in native trees stag-headedness is quite common. Chlorosis is controllable through the addition of iron by way of the sap or the soil.

Other diseases are due to cryptogamic parasites, which are generally controllable by fungicides. Those observed during the year include *Fusicladium dendriticum* on apple; *F. pirinum* on pears; downy mildew and red root of onions; shot hole of apricot, peach, and almond; brown rot, scab, melanose, sooty mold, and *Sphaerella citri* on orange; brown rot of lemons; take-all (*Ophiobolus graminis*), nematode disease, Septoria, smut, and rust of wheat; nematode in beet root; *Armillaria mellea* in rhubarb; *Septoria lycopersici*, Irish blight, and sleeping sickness in tomato; and club root of cabbage.

Report [on plant diseases, Surinam], G. STAHEL (*Dept. Landb. Suriname Verslag, 1918, pp. 14–16*).—Very brief notes are given regarding plant diseases and control measures as referring to rubber, coffee, and cacao in Surinam.

Mosaic disease of corn, E. W. BRANDES (*Jour. Agr. Research* [*U. S.*], *19* (*1920*), *No. 10, pp. 517–521, pl. 1*).—In a communication from the Bureau of Plant Industry of the U. S. Department of Agriculture, the author describes the mosaic disease of corn, a preliminary note of which has been previously reported (E. S. R., 42, p. 449).

This disease of corn was noticed first in Porto Rico, later in New Orleans, La., and near Cairo, Ga., and was thought to be the same disease that has been reported in Hawaii, Guam, and elsewhere. While comparatively little study has been done with this disease, it is believed that all varieties of corn do not respond in the same way in regard to susceptibility.

The symptoms of the disease are described, the most characteristic of which is a streaked and irregularly mottled appearance of the leaves. Infected plants are always lighter in color than healthy ones, and from observations made in Louisiana, it appears that the infected plants are inclined to be sterile. Transmission of the disease by the corn aphis (*Aphis maydis*) has been proved.

For the control of the disease, the author recommends the destruction of affected plants as soon as observed.

Dry spot of oats, J. HUDIG and C. MEIJER (*Dept. Landb., Nijv. en Handel* [*Netherlands*], *Verslag. Landbouwk. Onderzoek, Rijkslandbouwproefsta., No. 23* (*1919*), *pp. 1–39, pl. 17*).—This work stands in relation with that of Krüger and Wimmer (E. S. R., 29, p. 151; 33, p. 847), that of Clausen (E. S. R., 29, p. 151), and that of Hudig (E. S. R., 32, p. 442).

It is stated that dry spot occurs in oats cultivated in clean quartz sand with a certain mixture of alkaline salts. Admixture of oat roots and stems on sand, independently of early or late seeding or temperature, produced oat sickness as did also extract of oat roots, though leaves gave rather a favorable effect. A culture having acid reaction, or developing salts neutralizing alkali, showed no dry spot. Nitrates did not produce dry spot. Manganese is deemed the best remedy for this condition.

Dry spot of oats, J. HUDIG and C. MEIJER (*Dept. Landb., Nijv. en Handel* [*Netherlands*], *Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 23* (*1919*), *pp. 128–158, pls. 15*).—The data on which the conclusions above noted were based were obtained from work done in 1915 to 1917. In 1919 further study of dry spot was begun, the results of which appear below.

Oat sickness (dry spot) presents two distinct characters designated as striping and spotting, respectively. The first of these is closely associated with alkalinity of the soil solution and may sometimes cause serious injury. The second causes usually little or no loss. Injury attends the addition of cellulose or potato starch flour in alkaline preparations, acid apparently opposing such

result, as does also powdered sulphur, probably through the development of sulphuric acid. Nitrates do not cause the disease.

Genetics of rust resistance in crosses of varieties of Triticum vulgare with varieties of T. durum and T. dicoccum, H. K. Hayes, J. H. Parker, and C. Kurtzweil (*Jour. Agr. Research [U. S.], 19 (1920), No. 11, pp. 523-542, pls. 6*).—The results are given of a cooperative investigation between the Minnesota Experiment Station and the Bureau of Plant Industry of the U. S. Department of Agriculture, in which the genetics of rust resistance was studied. Crosses were made of several varieties of common wheat, all of which are susceptible to the black stem rust (*Puccinia graminis*), with varieties of durum wheat, which are considered commercially resistant, and with White Spring emmer, which is very resistant to the rust.

The F_1 generation of crosses between durum and common varieties was found to be as susceptible as the commn parent, while F_1 crosses between the practically immune emmer parents and susceptible commons were about as resistant as the durum varieties. In crosses where emmer was one parent, resistance was partially dominant, while in crosses between durum and common wheat, susceptibility was completely dominant.

Greenhouse inoculation studies with a common strain of *P. graminis* showed that durum, common, and emmer type plants were obtained in the F_2 or F_3 generation which were more resistant than the resistant durum parents, showing a transgressive segregation of rust resistance. In crosses between resistant emmer and Marquis in the F_3 generation, several lax-headed wheats were obtained which had the head shape and naked kernels of common wheats and which were rust-resistant. This is believed to indicate that rust resistance in common wheat can be obtained by crossing susceptible common varieties with resistant emmers.

The mode of inheritance of rust resistance is considered entirely comparable with the general Mendelian manner of inheritance of botanical and morphological characters.

The nematode disease of wheat caused by Tylenchus tritici, L. P. Byars (*U. S. Dept. Agr. Bul. 842 (1920), pp. 40, pls 6, figs. 6*).—The results are given of an extended study of the nematode disease of wheat due to *T. tritici*, which is said to be now known to occur in California, Virginia, West Virginia, Maryland, and Georgia, as well as to be widely distributed throughout other portions of the world.

Samples of wheat collected in Virginia contained from less than 1 per cent to more than 50 per cent of diseased kernels, and in some instances as much as 40 per cent damage was reported due to this parasite.

The nematode is considered primarily a parasite of wheat, and to a less extent is said to be parasitic on rye, oats, spelt, and emmer. It has also been reported as occurring on barley.

The author claims the disease may be controlled by the use of nematode-free seed in combination with the employment of a 2 or 3 year crop rotation, together with the application of proper sanitary precautions. Wheat for planting should be secured, so far as possible, from localities where the disease does not occur, but nematode-free seed may be obtained from diseased grain by floating off the galls in a 20 per cent salt solution and then treating the remaining wheat with water at a temperature of 50 to 52° C. for 10 minutes. Diseased seed may also be freed from nematodes without removing the galls by immersing the seed in water at a temperature of 54 to 56° C. for 10 to 12 minutes.

On the amount of copper required for the control of Phytophthora infestans on potatoes, O. Butler (*Phytopathology, 10 (1920), No. 5, pp. 298-304,*

figs. 3; also in New Hampshire Sta. Sci. Contrib. 16 (1920), pp. 298–304, figs 3).—Experiments were conducted to determine the minimum amount of copper required to control the late blight of potato, and also to determine whether frequency of application has any appreciable effect upon the amount of copper that must be applied. The amount of copper required per acre per annum in order to prevent loss due to attacks of *P. infestans* is said to lie between 24 and 26 lbs. One per cent Bordeaux mixture 1:0.5 is superior to 1 per cent Bordeaux mixture 1:1 for the control of late blight. Two per cent Bordeaux mixture 1:0.5 applied fortnightly is superior to both 1 per cent Bordeaux mixture 1:0.5 and 1:1 applied every week. Of the two proprietary copper fungicides experimented with, the one giving a mixture rich in copper was found very superior to the one giving a mixture weak in copper.

The author claims that it is not only necessary to apply a certain amount of copper per acre per annum, but also that equivalent protection is not obtained by simply making up any deficiency in the strength of the Bordeaux mixture used by increasing the number of applications. There was no relation found between concentration and toxicity, but there was an apparent relation between composition and adhesiveness, and to this factor the author attributes the differences in protective power of the Bordeaux mixture used.

Efficiency factors in potato spraying, W. H. Rankin (*Quebec Soc. Protect. Plants [etc.], Ann. Rpt., 11 (1918-19), pp. 49–55*).—The author, seeking to emphasize important factors in potato spraying, discusses particularly such diseases as early and late blight and tip burn, the destructiveness of all of which are determined largely by weather conditions in July and August.

Consideration is given also to factors determining effectiveness in spraying. A strength of 4:4:50 or 5:5:50 in Bordeaux mixture is regarded as by far the most satisfactory in a spray for potatoes. The latter strength is said to have at least twice the colloidal factors contained in the former. Stronger mixtures are proportionately wasteful. The application is effective as soon as it dries. The spores of the early and late blight fungi borne by both wind and insects are killed by contact with the colloidal membranes giving off free copper or by the alkaline solution derived from the lime particles. The next most important factor influencing efficiency of spraying is the time of application with reference to rain periods, especially at the stage in the development of the potato when late blight causes its heaviest losses.

Potato diseases and their control, D. C. Babcock (*Ohio State Hort. Soc. Ann. Rpt. 51 (1918), pp. 88–90, fig. 1*).—Brief discussion is given of diseases attacking the potato plant as controlled by selecting healthy seed tubers, by treating the tubers before cutting, and by spraying the plants with Bordeaux mixture.

The gummosis of sugar cane, J. Matz (*Porto Rico Dept. Agr. and Labor Sta. Circ. 20 (1920), Spanish ed., pp. 3–7, pl. 1*).—The author reports the observation in February, 1920, of a gummosis of sugar cane due to *Bacterium vascularum*. Based upon reports of the occurrence of this disease in other localities, the author recommends as far as possible the planting of varieties not subject to attack.

Observations on a fungus which causes a red rot of sugar cane stems, P. A. van der Bijl (*Union So. Africa Dept. Agr., Sci. Bul. 11 (1918), pp. 8, figs. 6*).—This paper gives an account of the study of a sugar cane disease fungus stated to be *Cephalosporium sacchari*, now recorded for the first time in South Africa.

Infection studies proved the pathogenicity of the fungus, which is, however, weakly parasitic, spreading slowly in the cane stalks, especially in lateral directions.

The main economic importance of the fungus is connected with its ability to invert sucrose. It has not been observed to fruit on cane, though the rotting of the cane may free the spores. Certain cane leaf spots may be due to this fungus. Suggestions for control include the destruction of infected cane and careful selection of planting material.

Eradication as a means for the control of the mosaic or mottling disease of sugar cane, F. S. EARLE (*Porto Rico Dept. Agr. and Labor Sta. Bul. 22 (1920), Spanish ed., pp. 3–19*).—This is a Spanish edition of a publication previously noted (E. S. R., 43, p. 47).

Tomato wilt, C. W. EDGERTON and C. C. MORELAND (*Louisiana Stas. Bul. 174 (1920), pp. 3–54, figs. 19*).—The results are given of an extended study of the tomato wilt due to *Fusarium lycopersici*. This disease is said to be widely distributed throughout the warmer portions of the world, being common in the United States as far north as the Ohio Valley and New Jersey. It attacks tomato plants through their roots and grows up through the fibrovascular bundles into the stems, leaves, and sometimes the fruits.

While the disease is not usually carried on the seed, the spores of the fungus will live on the seed from the time it is harvested until planting time, the following spring.

The length of time the fungus lives in the soil is said to be unknown, but it decreases from year to year so that by the third year there is not usually enough in the soil to produce a heavy infection. Wilt is said to develop best in a light, rich soil, and is of little importance in heavy, alluvial soils. The addition of lime in large amounts to the soil tends to hinder the development of the wilt, and it can be checked to some extent in the seed beds by treating them with formaldehyde and corrosive sublimate solutions.

A study of the organisms shows that there are different strains which show some slight variations in regard to virulence, but no evidence has been obtained that would indicate there are different strains of the organisms attacking different varieties of tomatoes.

In the field the normal development of the disease takes place after the soil has reached the optimum temperature, which is around 29° C. (84.2° F.). Strains or varieties of tomatoes showing resistance or tolerance to the disease have been selected at the Louisiana Stations and elsewhere, and it has been found from a number of observations that while the selections become infected with wilt, the more tolerant plants do not die as quickly as susceptible ones.

Control measures recommended for preventing the disease consist of rotation, seed bed sanitation, and the use of resistant and early varieties.

Dusting and spraying suggestions for Quebec, C. E. PETCH (*Quebec Soc. Protect. Plants* [etc.], *Ann. Rpt., 11 (1918–19), pp. 27, 28*).—For conditions as they exist in Quebec, the author considers lime sulphur, when carefully applied, the equal of Bordeaux mixture. Hydrated lime may in time, it is thought, replace quicklime in this preparation. Perfect results during the previous two years were given by both spraying and dusting, though the latter is recommended in case of orchards requiring over two days for the application of the spray. It is considered improbable that a spray calendar can be made that will be applicable universally over even a limited area.

Five years' experimental work in dusting apples, W. S. BROCK (*Ind. Hort. Soc. Trans. 1918, pp. 150–156, fig. 1*).—No better results were obtained from the application of sulphur on two sides than with the one-sided application. Two seasons' work is said to have shown that the same dusting sulphur when combined with glue and applied as a wet spray failed to reduce apple scab materially, and had practically no effect on apple blotch.

Apple blotch, R. C. WALTON (*Ohio State Hort. Soc. Ann. Rpt. 51 (1918), pp. 48–51*).—Apple blotch (*Phyllosticta solitaria*) is reported as becoming one of the most serious apple diseases in Ohio. Already distributed in other States and working northward, it causes damage estimated to range as high as 75 to 90 per cent of the apple crop.

The disease is described as occurring on fruit, twigs, and leaves, overwintering in cankers, though not in the mummied fruit. Infection seems to occur largely in the earlier part of the season. Susceptible varieties are indicated.

Control depends upon early removal of infectious material and spraying with Bordeaux mixture (3:4:50) if the disease is severe, otherwise (especially in wet weather) with lime sulphur (33° Baumé) diluted at the rate of 2½ gal. to 100 of water. Bordeaux mixture, regarded as by far the most efficient fungicide, is to be applied 3, 5, and 7 weeks after the petals fall.

The control of frog-eye on apple, R. C. WALTON (*Pennsylvania Sta. Bul. 162 (1920), pp. 39, figs. 19*).—Results are given of two seasons' work on the control of frog-eye, a leaf disease of apple caused by *Physalospora cydoniæ*. This disease has been so serious in parts of Pennsylvania as to cause almost complete defoliation of the trees early in August, with the result that the fruit is undersized and the trees are weakened.

Little difference has been noted in the susceptibility of different varieties, although the York Imperial and Stayman Winesap, two varieties of commercial importance, are said to be very susceptible to attacks.

Experiments were conducted to find the time of infection, and it was learned that some infection takes place during the blooming period. Most of it, however, occurs from the time the petals fall until two and one-half weeks later.

Experiments for the control of the disease were carried on in three different orchards, Bordeaux mixture, lime sulphur, two proprietary fungicides, and a dust composed of 85 parts sulphur and 15 parts lead arsenate being used. Bordeaux mixture, lime sulphur, and Pyrox, if applied at the proper times, were all effective for the control of frog-eye, Bordeaux mixture giving slightly the best results.

Considerable foliage injury resulted from the use of copper sprays, and lime-sulphur caused a slight amount of burning around the edges of the leaves. Sulfocide was not sufficiently effective for use as a spray for the prevention of frog-eye, and the one trial with the dust preparation showed it to be ineffective.

Based upon the experiments thus far conducted, the author recommends spraying just before the blossoms open, a second application when three-fourths of the petals have fallen, to be followed with another spraying two weeks later and a fourth application about the middle of June. In addition to spraying, pruning and burning of all dead twigs, cultivation, and other sanitary measures are recommended.

Controlling pear scab in the Pacific Northwest, D. F. FISHER and E. J. NEWCOMER (*Better Fruit, 14 (1920), No. 9, pp. 3–6, figs. 7*).—Scab, the only fungus disease of importance in the region covered by this article, and controllable by proper spraying, causes heavy losses each year, owing partly to climatic conditions. Fruit, foliage, and twigs are attacked. Four seasonal treatments are outlined.

Some prevalent diseases of stone fruits and their control, A. FRANK (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 6, pp. 90–92*).—Popular descriptions are given of diseases of cherries, plums, prunes, and peaches, and control measures adapted to western Washington conditions are recommended.

The Panama disease of bananas, E. W. BRANDES (*Agr. News [Barbados], 19 (1920), Nos. 465, p. 62; 466, pp. 78, 79, 467, pp. 94, 95; Trop. Agr. [Ceylon], 54

(1920), No. 6, pp. 357–363).—A condensed account of studies previously noted (E. S. R., 43, p. 848).

Further data on the orange rusts of Rubus, L. O. Kunkel (*Jour. Agr. Research [U. S.], 19 (1920), No. 10, pp. 501–512, pls. 4*).—In a previous publication (E. S. R., 37, p. 457), the author calls attention to two forms of orange rust occurring on species of Rubus. Further investigations have been conducted by the Bureau of Plant Industry, U. S. Department of Agriculture, and the telia of *Gymnoconia interstitialis* have been collected on leaves of wild black raspberry plants growing near Washington, D. C., which show the long-cycled rust to be present in that locality. The rusts on the blackberry and dewberry plants, so far as observed, have been found to be short-cycled in this same region.

The influence of temperature on germination of the spores has been claimed to be the cause of difference. The author repeated investigations and found that spores taken from blackberry leaves always produced promycelia, while those from black raspberry leaves produced long germ tubes. Temperature, within the range tested, had no effect on the manner in which the æciospores of the two rusts germinated.

A comparison of the rusts as they occur on their living hosts showed important differences in the color of the spores in mass. The spores of the short-cycled rust are lighter in color than those of the other, being a cadmium orange according to Ridgeway's color chart, while those of the long-cycled rust are xanthine yellow.

Some differences are noted in the morphological characters of the species, and the genetic relationship of the two rusts is discussed at some length.

The blister rust disease of currants and pines, H. L. Bailey (*Vt. State Hort. Soc., Ann. Rpt. 16 (1918), pp. 7, 8, figs. 2*).—The most severe infections of white-pine blister rust in Vermont are reported to have been found in Woodstock and Lyndon. The Connecticut River Valley, said to be the best pine region in the State, is reported as generally infected.

The point of infection has been determined as in the needles, the growth of the fungus on the bark becoming visible 2 or 3 years to 18 years later, according to the general belief. No case of recovery of affected pines is known, the only remedial measure being the removal of Ribes to a distance of at least one-third of a mile from the pines. Wild prickly gooseberries and skunk currants constitute the most dangerous obstacle to the control of this disease, but experiments during 1917 and 1918 indicate the practicability of control by eradication of Ribes if thoroughly carried out.

The white pine blister rust situation in Quebec, H. Roy (*Quebec Soc. Protect. Plants [etc.], Ann. Rpt., 10 (1917–18), pp. 25–30*).—This disease is revealed by inspection activities to exist in the counties of Lotbiniere, Nicolet, Wolfe, Megantic, Richmond, Sherbrooke, and Shefford. The economic importance of the disease in this region is very great, since the white pine reproduces itself inadequately in the forests and possible substitutes are seriously threatened by insects and disease.

Brown bast of Hevea rubber, R. D. Anstead (*Planters' Chron., 14 (1919), No. 22, pp. 320–324*).—This lecture was delivered at a meeting of the South Indian branch of the Rubber Growers' Association at Cochin, May 17, 1919, as part of a movement to correlate views variously held in different localities regarding the causation and ultimate nature of the disease here designated as Hevea brown bast.

The disease is not fatal. It is not spread by the tapping knife, though trees are not attacked before being tapped. Suggestions are made regarding a cor-

related study of the disease, conditions associated with its appearance, and measures directed to its control.

Culture experiments with Melampsora in Japan, T. MATSUMOTO (*Ann. Missouri Bot. Gard., 6 (1919), No. 4, pp. 309–316. figs. 3*).—Following an account of his former study (E. S. R., 35, p. 251), said to be the first reported from Japan regarding the interrelationships between the different spore types of *Melampsora* spp. and their hosts, the author has determined additional species, and gives in the present report more or less descriptive discussion of a Melampsora on *Salix babylonica* (cæoma stage on leaves of *Chelidonium majus*), another on *S. capræ*, and a third on *Populus balsamifera*, identified as *M. larici-populina*. The species studied (as regards uredo and teleutospores) in connection with *S. urbaniana* has its cæoma stage on *Larix decidua* and is described as a new species under the name *M. larici urbaniana*.

Humidity in relation to moisture imbibition by wood and to spore germination on wood, S. M. ZELLER (*Ann. Missouri Bot. Gard., 7 (1920), No. 1, pp. 51–74, pl. 1, figs. 5*).—Following studies previously reported (E. S. R., 37, p. 727) in which it was found that the capacity of wood to absorb moisture and any property influencing this capacity are factors in its durability, and employing the results obtained from these studies as a foundation for further work, the author has attempted to ascertain what amounts of moisture wood will absorb from the atmosphere at different relative humidities under constant temperatures, and what relation the moisture content of wood (or relative humidity of the atmosphere) bears to the propagation of wood destroying fungi as such.

The woods selected for the tests include *Pinus echinata* and *P. palustris*, 250 specimens of each being taken in order to cover a wide range as to resin content, specific gravity, and proportion of sap wood to heart wood. The work is described in detail, and the results are tabulated with discussion showing the moisture content of wood at 25° C. and various atmospheric humidities.

It was found possible to approximate the saturation point for the wood fibers. The curves of highly resinous samples show the water-proofing effect of resin on wood, especially above 50 per cent humidity, though resin can not be relied upon as an indicator of the durability of lumber, even when as high as 12 to 15 per cent, on account of its usually irregular distribution; regions of low resin content being sources of weakness if invaded under favorable moisture conditions by wood-destroying fungi.

Spores of *Lenzites sepiaria* germinate on wood shavings at 63 to 100 per cent humidity, germination being greatly accelerated under conditions of fiber saturation.

A humidor (provided with a dew-point apparatus and a convenient weighing device) for maintaining constant conditions of humidity and temperature is described.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Experiments on the toxic action of certain gases on insects, seeds, and fungi, I. E. NEIFERT and G. L. GARRISON (*U. S. Dept. Agr. Bul. 893 (1920), pp. 16*).—This is a report of experiments conducted with certain toxic gases to determine their value for fumigating purposes. The experiments were planned by a committee of four, and are the outcome of experiments on the action of toxic gases on the body louse, conducted in cooperation with the War Department. In the course of the work nearly 800 fumigations were made, in which

20,000 insects of about 15 different species were used. The data, which are presented in tabular form, have led to the following conclusions:

"Phosgene is not useful as an insecticide, because of its toxicity toward human beings, its high vapor pressure, the difficulty of controlling it, and its comparatively low toxicity toward insects. Neither does it possess any value as a fungicide. Arsine has no advantage other than ease of generation, and possesses many disadvantages as an insecticide. Its toxicity toward insects is comparatively low, it is injurious to plants, and has no effect on fungi. Illuminating gas in concentrations up to 3 per cent and for exposures up to two hours is not toxic to insects. Carbon monoxid in concentrations up to 3 per cent and for exposures of two hours is not toxic to insects.

"Of the gases tested, cyanogen chlorid and chloropicrin give promise of being useful for fumigation purposes. Neither of these, however, can be used in greenhouse fumigation because of their injurious action on plants. Nevertheless they probably can be used in the fumigation of stored products. The efficiency of chloropicrin as an insecticide is undoubted. In general, it is more poisonous to stored-product insects than hydrocyanic acid. Other advantages which it possesses are ease of handling and control, low toxicity toward human beings, ease of detection, and noninflammability. Its disadvantages are its adherent quality, which makes it necessary to air the material for some time after it has been fumigated, its corrosive action on metals, its severe lachrymal effect, and its low volatility. The last objection may be partially overcome by pouring the dose required on paper, thereby increasing the evaporating surface.

"As an insecticide, the effect of cyanogen chlorid is practically the same as that of hydrocyanic acid. Its disadvantages are its injurious effect on plant life, low boiling point, slightly corrosive action on metals, and severe lachrymosal effect. Its advantages are that it is active as a fumigant, is easily detected, is not injurious to seeds in doses which are toxic to insects and fungi, and is no more toxic toward human beings than hydrocyanic acid. It is safer to use than hydrocyanic acid because it can be detected in lower concentrations."

Chemical insecticides and fungicides, S. H. Collins (In *Chemical Fertilizers and Parasiticides. London: Baillière & Cox, 1920, pp. 239–255*).—The first section of this account (pp. 239–248) deals with inorganic poisons, and the second section (pp. 249–255), with organic poisons. References to the literature are given for both sections.

The fight against the rat, H. Johansen (*Dom. Repub. Sec. Estado Agricult., Vulgar. Agr., Hoja 1 [1920], pp. 4*).—This is a brief popular account.

Game laws for 1920, G. A. Lawyer and F. L. Earnshaw (*U. S. Dept. Agr., Farmers' Bul. 1138 (1920), pp. 84*).—This is the annual summary of the provisions of Federal, State, and Provincial game legislation.

Hand list of the birds of Egypt, M. J. Nicoll (*Egypt Min. Pub. Works, Zool. Serv., Pub. 29 (1919), pp. XII+119, pls. 32*).—This is an annotated list of 436 forms occurring in Egypt. Eight plates of 26 forms are in colors.

Revision of the avian genus Passerella, with special reference to the distribution and migration of the races in California, H. S. Swarth (*Univ. Calif. Pubs., Zool., 21 (1920), No. 4, pp. 75–224, pls. 4, figs. 30*).—This is a revision of *P. iliaca*, the fox sparrow, the only species of the genus. It is confined to North America, being distributed over the greater part of the continent. Sixteen subspecies are formally recognized in the present paper, all of which are migratory, most of them traveling long distances between their summer and winter homes.

The paper includes a list of 67 references to literature.

The toad in the West Indies, H. A. B[ALLOU] (*Agr. News* [*Barbados*], *18* (*1919*), *No. 459, pp. 378, 379*).—This is a brief discussion of *Bufo marinus* or *B. agua*, the common toad in the West Indies. Apparently it does not occur in the Virgin Islands and Porto Rico, where steps are being taken to introduce it.

[Insect pests in Barbados] (*Barbados Dept. Agr. Rpt., 1917–18, pp. 29–31*).—The injuries caused to sugar cane by the root borer (*Diaprepes abbreviatus* Linn.) and the brown hardback (*Phytalus smithi* Arrow) are said to be increasing in intensity in certain districts of the island, where but little effort has been made in the past to control them.

A table is given which shows the number of larvæ of the two species collected from the basal portions of sugar canes on the manurial experimental plats at Bay Tree field at Dodds for the period 1916–18.

Annual report for 1919 of the zoologist, C. WARBURTON (*Jour. Roy. Agr. Soc. England, 80* (*1919*), *pp. 411–417*).—Records of the more important insect pests of the year are reported under the headings of the crops, etc., attacked.

[Contributions on economic insects] (*Ztschr. Angew. Ent., 6* (*1920*), *No. 2, pp. IV+185–416, figs. 144*).—Papers here presented, in continuation of those previously noted (E. S. R., 43, p. 51), include the following: Tachinidæ as Parasites of Insect Pests.—Their Life History, Economic Importance, and Classification, by W. Baer (pp 185–246); *Agrotis segetum* Schiff. and Its Importance as an Agricultural Pest, by R. Kleine (pp. 247–269); A Contribution to the Biology of the Rape-blossom Beetle (*Meligethes aeneus* Fab.), by F. Burkhardt and H. von Lengerken (pp. 270–295); The Hibernation of Muscids, by J. Wilhelmi (pp. 296–301); On the Knowledge of *A. segetum*.-*II*, by W. Herold (pp. 302–329); On the Knowledge of Larvæ and Pupæ of *Bucculatrix thoracella* Thbg., by L. Fulmek (pp. 330–337); Biological Notes from a Mosquito Field Station, by F. Eckstein (pp. 338–371); and A Simple Procedure for the Generation of Hydrocyanic Acid Gas from Sodium Cyanid Solution and Its Use in Combating Insects Pests, by A. Andres and A. Müller (pp. 372–389).

[Catalogue of insects of British East Africa], T. J. ANDERSON (*Brit. East Africa Dept. Agr., Div. Ent. Bul. 2* [*1919*], *pp.* [*10*]+*28*).—A list is given of insects injurious to coffee, citrus, maize, potatoes, crucifers, cucurbits, flax, cereals, sweet potatoes, coconut palm, rubber, fruit trees, castor oil, and stored products, as well as insects which attack domestic animals, beneficial insects, those which spread disease to man and animals in British East Africa. An index to generic and specific names is included.

Lantana insects in India, Y. RAMACHANDRA RAO (*India Dept. Agr. Mem., Ent. Ser., 5* (*1920*), *No. 6, pp.* [*5*]+*239–314, pls. 14, figs. 3*).—This is a report of an inquiry into the efficiency of indigenous insect pests as a check on the spread of Lantana in India.

Insects of the forest, H. BASTIN (*Jour. Bath and West and South. Counties Soc., 5. ser., 14* (*1919–20*), *pp. 38–60, pls. 6*).—A general account is first given, followed by discussions of some of the more important insects met with.

The insect enemies of polyporoid fungi, H. B. WEISS (*Amer. Nat., 54* (*1920*), *No. 634, pp. 443–447, figs. 4*).—The author has found 40 of the 50 species of polyporoids collected in New Jersey to be infested by insects. A list of the polypores and the insects found associated with them, listed according to order, is presented.

Manual of the Odonata of New England, R. H. HOWE, JR. (*Thoreau Mus. Nat. Hist. Mem. 2* (*1917–1920*), *pp. 102, pls. 3, figs. 277*).—This is a field manual, with a pictorial key of genera and illustrations of the diagnostic characters of species occurring in New England, 156 in number. The habitat, abundance, and limited dates of capture are recorded and the ranges largely mapped.

Manual of the Orthoptera of New England including the locusts, grasshoppers, crickets, and their allies, A. P. Morse (*Boston Soc. Nat. Hist. Proc., 35 (1920), No. 6, pp. 197–556, pls. 20, figs. 99: abs. in Science, n. ser., 52 (1920), No. 1341, pp. 251, 252*).—The author first discusses the history of New England orthopterology, classification, anatomy, habits, coloration, geographical distribution, economic importance, remedies, enemies, and methods of collection and preservation. The species, 132 in number, 16 of which are considered adventive, are then taken up in connection with tables for their separation (pp. 281–537).

An accented list of scientific names, a glossary of the subject, and an index are included. The review is by A. N. Caudell.

Grasshoppers, L. Moomaw (*North Dakota Sta. Bul. 138 (1920), p. 24*).—Attention is called to the fact that the worst infestation of grasshoppers known during recent years occurred during the season of 1919. On many farms the grain fields were entirely destroyed, and in practically every field within a radius of several miles of the station a high percentage of damage was done.

In the vicinity of the station the first young hoppers were noted May 23. Poisoning was commenced the next day and continued at intervals until July 18. As a result no great amount of damage was done at the station except in a field where the hoppers moved in from an adjoining rye field. Even the youngest stages ate the poisoned bran mash and were destroyed in great numbers. The work of the year showed the most effective results to be obtained by use of the bran mash within the first few days after the hoppers emerged from the ground.

A prepared grasshopper poison, D. B. Mackie (*Calif. Dept. Agr. Mo. Bul. 9 (1920), No. 5–6, pp. 194–197*).—The great need for a practical grasshopper poison in the more remote districts of California led the author and H. S. Smith to conduct experiments which resulted in the preparation of a concentrate that can be prepared and kept in cans, held in storage without deterioration. It consists of 5 lbs. of orange and grapefruit pulp finely ground, combined with 1 lb. white arsenic. When needed for use this concentrate is diluted with 4 gal. water and mixed with 25 lbs. bran, one can being sufficient to treat 5 acres of ground. This mash may be distributed, as in the standard formula, by means of an end-gate seeder, which gives excellent results. When tried out in San Bernardino County in alternate rows with the fresh mixed standard bran mash formula it was impossible to distinguish any difference in the kill. Tests made of samples sent to the Arizona State entomologist gave similar results.

Key to the North American species of Physothrips (*Fla. Ent., 3 (1920), No. 4, p. 71*).—A key is given to six species of Physothrips.

The coffee bug.—Antestia lineaticollis Stal., T. J. Anderson (*Brit. East Africa Dept. Agr., Div. Ent. Bul. 1, pp. [3]+53, pls. 4*).—A detailed report of studies of the life history, habits, natural enemies, and means of control of this pest, which is a source of serious injury to the coffee berry in British East Africa.

The rice leaf-hoppers (Nephotettix bipunctatus Fabr., and Nephotettix apicalis Motsch), C. S. Misra (*India Dept. Agr. Mem., Ent. Ser., 5 (1920), No. 5, pp. [2]+207–239, pls. 4, figs. 9*).—The rice leaf-hoppers here considered were reported for the first time damaging rice in the Sambhalpur District in the Province of Bihar and Orissa in 1910, and four years later were reported to have damaged 300,000 acres, causing a loss of approximately 14,000,000 rupees in the Chhattisgarh Division alone of the Central Provinces. The present paper deals with studies of the life history and habits of the two species and with control measures.

On the classification and natural history of the Psyllidæ, particularly of Psyllopsis fraxini L., A. KRAUSSE (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *46* (*1916*), *No. 1–5, pp. 80–96, pl. 1, figs. 30*).—This account includes a bibliography of 38 titles.

Control of aphids injurious to orchard fruits, currant, gooseberry, and grape, A. L. QUAINTANCE and A. C. BAKER (*U. S. Dept. Agr., Farmers' Bul. 1128* (*1920*), *pp. 48, pls. 4, figs. 34*).—This is a popular summary of information, in which 41 species are discussed. The more important forms affecting a given fruit are considered first, and then follows a brief account of species known to infest the plant locally or occasionally, and which growers should be able to distinguish from the more destructive species. Several colored plates which illustrate the life history, food plants and nature of the injury, and other habits of the rosy apple aphis, the green apple aphis, and the apple grain aphis are included.

Black fly on citrus trees, S. F. ASHBY (*Jour. Jamaica Agr. Soc.*, *24* (*1920*), *Nos. 3, pp. 72–74; 6–7, pp. 182–184*).—A summary of information on the economic status of the spiny citrus white fly (*Aleurocanthus woglumi*) in Jamaica.

Proper treatment of purple scale, J. R. WATSON (*Citrus Indus.*, *1* (*1920*), *No. 8, pp. 12–14, 19*).—This is a popular summary of information.

On the metamorphosis of the salivary glands of Bombyx mori L., H. ITO (*Bul. Imp. Tokyo Sericult. Col., Japan*, *1* (*1916*), *No. 3, pp. 45–55, pls. 2*).—The author's observations have been summarized as follows:

"The histolysis of the salivary glands is not accomplished by the direct action of the leucocytes, but by the interference of the leucocytes. The leucocytes act secondarily after the degeneration has undergone to certain extents. The histogenesis of the salivary glands is accomplished by the new elements originated from the embryonal cells, which are lying mostly in the anterior portion of the larval glands."

On the glandular nature of the corpora allata of the Lepidoptera, H. ITO (*Bul. Imp. Tokyo Sericult. Col., Japan*, *1* (*1918*), *No. 4, pp. 63–103, pls. 7*).—The corpora allata were found as paired organs in all the species of Lepidoptera examined by the author, being organs of internal secretion which function actively in the imaginal stage.

A bibliography of 63 references to literature is included.

The nomenclature of the parts of the male hypopygium of Diptera nematocera, with special reference to mosquitoes, F. W. EDWARDS (*Ann. Trop. Med. and Parasitol.*, *14* (*1920*), *No. 1, pp. 23–40, figs. 2*).—This study includes a list of 27 references to the literature.

The slender wireworm: Its relations to soils, G. M. ANDERSON (*South Carolina Sta. Bul. 204* (*1920*), *pp. 14, figs. 4*).—This is a report of studies made in cooperation with the Bureau of Entomology, U. S. Department of Agriculture, of *Horistonotus uhlerii* Horn in its relation to soils, an account of which wireworm has been previously noted (E. S. R., 33, p. 158).

The studies have shown that the soils infested by it are principally fine and very fine sands. These soils are found to be low in sands classed as coarse and medium and also low in silt and clay. The range in percentage of total sands for the top soil was from 89.22 to 93.7, and for the subsoil 88.94 to 95.38. *H. uhlerii* is the most important species found in Colleton, Jasper, Hampton, and Beaufort Counties; it also occurs in Horry, Marion, Charleston, and other counties, where it causes minor injury as compared with other species. The soils infested by it are of such texture and structure that saturation with water is almost impossible. It appears that the larvæ of *H. uhlerii* die almost immediately when the soil in which they are living becomes saturated with water, or else crawl out on the surface where they become the prey of birds.

The strawberry weevil in Tennessee, S. MARCOVITCH (*Tenn. State Bd. Ent. Bul. 30 (1919), pp. 17, pl. 1, figs. 12*).—This is a summary of information on this pest in Tennessee, including its life history, habts, and means of control. Fields with from 40 to 95 per cent of the buds cut are not uncommon in certain sections of the State.

[The mango seed weevil (Cryptorhynchus mangiferæ) in Hawaii], J. E. HIGGINS (*Hawaii Sta. Rpt. 1919, pp. 22, 23*).—This weevil is said to have become a very prevalent pest in Hawaii. It remains within the husk of the seed until sometime after the fruit is ripened and does not pollute the flesh of the mango nor detract from its external appearance. Its presence within the seed, however, often affects the appearance and even the flavor of a portion of the flesh surrounding the seed. Its greatest injury is done to the seed, which if allowed to remain within the husk is usually destroyed. It is estimated that about 90 per cent of all the seeds opened at the station during the season of 1919 were weevil infested, and therefore unfit for propagation.

One of the various means that have been tried to save the seed from complete destruction consists in cutting open the husks as soon as it can be cleaned and slightly dried. If the seed is found to be weevil infested but not yet fully destroyed the insect can be killed, the seed cleaned, and then planted. If all the embryos of the seed, many of which are polyembryonic, have been destroyed the seed will not germinate, but if one or more of these remain uninjured, the seed can be expected to grow. Seed planted without the husk require about 18 days to germinate, while those planted with the husk require on an average about 40 days.

"A less expensive, but less effective, method tried for the destruction of the insect consisted in making one rapid cut at the lower end of the seed, after which the seeds were placed in a sack and submerged in water for one hour. Seeds so cut were also fumigated and the weevil, which manifests a high degree of resistance, killed. The seed when cut open is moist within, but determination has not been made as to whether it can endure as much fumigation as the weevil will, or whether the frass or refuse created by the weevil will contribute to the decay of the injured seed."

Behavior of bees in fall, F. MANDERY (*Washington Sta., West. Wash. Sta., Mo. Bul., 8 (1920), No. 6, pp. 93, 94*).—This is a popular account of the response of the honey bee to its environment.

Some observations on European foul brood, G. F. WHITE (*Amer. Bee Jour., 60 (1920), Nos. 7, pp. 225–227, figs. 5; 8, pp. 266–268, figs. 4*).—This account is based upon investigations previously noted (E. S. R., 43, p. 58).

A mite disease affecting sweet peppers, C. W. CARPENTER (*Hawaii Sta. Rpt. 1919, p. 53, pl. 1*).—A peculiar condition of sweet peppers growing in hot and dry situations, characterized by the curling and stunting of the young leaves and buds, was found to be due to a mite. A small scale experiment showed that the application of sulphur or lime-sulphur spray controlled the mite, as well as that affecting the potato.

FOODS—HUMAN NUTRITION.

Properties affecting strength in wheaten flour, F. J. MARTIN (*Jour. Soc. Chem. Indus., 39 (1920), No. 14, pp. 246T–251T*).—This is a report of a study of the relation between various properties of flour and its "strength," this being defined as "the capacity of a flour to produce a large and well-piled loaf." Factors previously suggested by other investigators as determining the strength of flour were studied, including total amount of gluten, the gliadin-glutenin ratio, the amount of gas obtained during the fermentation, and the concentra-

tion of electrolytes, especially phosphates. Observations were also made of the gas-retaining capacity of the dough, the water-soluble proteins, and the baking marks. The flours examined were straight grade flours from single wheats, differing widely in baking properties and in origin. The conclusions drawn from the reported results are as follows:

"No correlation appears to exist between strength and the amounts of total soluble extract, soluble phosphorus, or acidity.

"A strong flour must possess a minimum gas-producing capacity as measured by the amount of gas produced by fermentation during 24 hours. A deficiency in this respect can be rectified by the addition of an amylolytic enzym, e. g., a diastatic preparation. A strong flour possesses a high gas-retaining capacity. This has been shown to be due to the amount and form of the proteins in the flour.

"The water-soluble protein increases with the length of the period of extraction, probably due to proteolytic enzym action, at the expense of the alcohol-soluble protein. In estimating the gliadin present in flour it is necessary to make allowance for the water-soluble proteins, which are soluble to a great extent in dilute alcohol. Flours with high gas-retaining capacities and high bakers' marks have been shown to be those in which the 'amended gliadin' figure is also high.

"For flours having a satisfactory gas-producing capacity, bakers' marks, gas-retaining capacity, and 'amended gliadin' content are closely related, and it is considered that the estimation of either of the latter together with the determination of the gas-producing capacity will indicate the 'strength' of the flour."

The heat of hydration and specific heat of wheat flour, F. Daniels, B. H. Kepner, and P. P. Murdick (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 760–763*).—This paper consists of a study of the relationship of the temperature of the flour and water to the resultant dough in breadmaking and a comparison of this relationship with empirical formulas in general use in the baking industry.

The heat of hydration of various wheat flours was found to range from 7.6 B.t.u. per pound in a low grade to 5.4 B.t.u. per pound in a winter wheat flour, with an average value of 6.5 B.t.u. per pound for a straight flour such as is used in bakeries. The heat of hydration decreased on exposure to the atmosphere, but did not change appreciably on aging when completely isolated from the air. The average specific heat of flour was found to be 0.43 or about 0.34 on a moisture-free basis.

For the calculation of dough temperatures it is thought necessary to consider both the specific heat and heat of hydration. Formulas are given for this calculation under different conditions. For ideal conditions in which the room temperature is close to 80° F. and the heat generated by mechanical means is negligible, the required temperature of the water can be calculated by the formula $T_w=125-0.7\ T_f$ where T_w and T_f are the temperatures of the water and flour, respectively. It is pointed out that for practical use in bakeries the formula must be modified with the help of data taken under actual working conditions.

The cooking of frozen meats, J. Bruna (*La Cuisine des Aliments Frigorifiés. Paris: Assoc. Française du Froid, 1919, pp. 40*).—Following a brief discussion of the general principles involved in the practice of refrigeration, directions are given for the treatment and cooking of cold-storage products including beef, pork, mutton and veal, poultry, game, and fish. Several recipes are given under each section.

Bacterial decomposition of salmon, A. C. HUNTER (*Jour. Bact., 5 (1920), No. 4, pp. 353–361*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, consists of the report of the bacteriological examination of four varieties of salmon from the time of catching until put into the cans. Total counts of bacteria were made from time to time from the muscle tissue of the back and belly of the fish, and agar slant cultures from various parts and organs, including the mouth, gills, stomach, ceca, intestines, heart, liver, and kidney. Cultures in lactose broth fermentation tubes were made from the stomach, ceca, and intestines.

The muscular tissue and digestive tract of the freshly caught salmon were sterile, while the mouths and gills contained living organisms of various kinds, even when fresh from the water. After 96 hours, at temperatures between 50 and 70° F., the total count of bacteria in the muscular tissue was found to be as high as 155,000,000 per gram. By thoroughly washing the fish on arrival at the dock, lower total counts of bacteria were obtained on standing, and the washed fish decomposed less rapidly than the unwashed. All of the fish kept out of water for more than 48 hours, at temperatures between 50 and 70° F., were decomposed to such an extent as to be undesirable as food.

A highly resistant thermophilic organism, P. J. DONK (*Jour. Bact., 5 (1920), No. 4, pp. 373, 374*).—The cultural characteristics are outlined of a thermophilic organism isolated from spoilage samples of Standard Maine Style corn which had been packed in the usual way and processed at 118° C. for 75 minutes. The same organism was also obtained in spoiled string beans and corn on the cob.

The organism is a spore-forming, nonmotile, Gram-negative aerobe or facultative anaerobe. It forms a cloudy growth in nutrient broth, moderate filiform growth on agar stroke, growth without liquefaction in gelatin at a temperature of 60 to 65°, and growth with acid production on glucose, lactose, and sucrose agar, and in corn infusion. The optimum, maximum, and minimum temperatures for growth were 50, 76, and 45°, respectively. In corn broth at an H-ion concentration of pH=6.1, at a temperature of 100° and a spore content of 12,500 per cubic centimeter, it required 17 hours to kill the organism, while in another sample of pH=6, temperature 120°, and 50,000 spores per cubic centimeter, 11 minutes were required.

The presence of copper in plants and particularly in food materials of plant origin, B. GUÉRITHAULT (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 3, pp. 196–198*).—The results are reported of a series of determinations of copper in various vegetables, fruits, cereals, and nuts. The analyses were conducted on from 200 to 1,000 gm. of fresh material, which was incinerated in a muffle furnace, the ash taken up with HCl, and evaporated to dryness on a water bath in a special aluminum dish. The copper was then precipitated as sulphid, dissolved in nitric acid, subjected to electrolysis, and finally determined gravimetrically or colorimetrically after the addition of ammonia to its solution in nitric acid.

Copper was found in all the substances examined in amounts varying from 8.7 to 63.6 mg. per 100 gm. of the ash and from 1.1 to 17.1 mg. per kilogram of the fresh material. The cereal grains and nuts were particularly rich in copper.

Nutrition and public health, with special reference to vitamins, J. F McCLENDON (*Amer. Jour. Med. Sci., 159 (1920), No. 4, pp. 477–497, fig. 1*).—A general discussion of food problems.

Some recent contributions to the literature of vitamins, their discords and harmonies, L. M. POTTER (*Internatl. Jour. Pub. Health, 1 (1920), No. 1, pp. 86–91*).—Attention is called to the apparent diversity of opinions and ex-

perimental facts in recent contributions to the literature of vitamins and to the possibility of harmonizing some of these diversities. This is followed by a brief discussion of the principal lines of investigation of the vitamins, including their existence, specificity, stability, autosynthesis, and practical importance. The literature of scurvy is then reviewed according to this outline. A list of 82 literature references is appended.

Studies in spasmophilia.—I, Spasmophilia and vitamins, L. von Meysenbug (*Amer. Jour. Diseases Children, 20 (1920), No. 3, pp. 206-210*).—The author reports an investigation of a possible relationship between spasmophilia of children and a deficiency in fat-soluble, antineuritic, and antiscorbutic vitamins.

The water-soluble, antineuritic vitamin was administered to infants showing spasmophilic reactions in three ways, by the oral administration of filtered autolyzed yeast, by subcutaneous injection of the yeast filtrate boiled for one minute, and by subcutaneous injection of a watery solution of the alcoholic extract of ether-extracted wheat embryo. None of the infants exhibited any permanent change in electrical irritability following administration of the vitamin, indicating that this abnormality was not due to a deficiency of water-soluble B.

That the fat-soluble and antiscorbutic vitamins were likewise not concerned in the etiology of spasmophilia was indicated by the observation that four infants after eight months on a diet free from fat-soluble vitamin showed no signs of spasmophilia, and that two cases of active infantile scurvy showed an unusually low electrical irritability.

"The very frequent association of spasmophilia and rickets, and the prominence which has recently been given to the fat-soluble factor in connection with rickets, serves only to add interest to the normal electrical reactions obtained in those children whose diet contained a minimal quantity of this factor."

A study of the antiscorbutic value of honey, H. K. Faber (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 113-116*).—In 9 out of a series of 10 guinea pigs fed on a diet of oats and water, supplemented with from 0.88 to 5.58 cc. daily of honey per 100 gm. of initial body weight, severe scurvy developed in from 4 to 6 weeks, indicating that the antiscorbutic vitamin is absent from honey.

Amino acid synthesis in the animal organism.—Can nor-leucin replace lysin for the nutritive requirements of the white rat? H. B. Lewis and L. E. Root (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 79-87, figs. 2*).—Attempts to replace lysin by either *dl*- or *d*-nor-leucin in experimental dietaries for rats, involving the use of lysin as a supplement to gliadin, resulted in cessation of growth. This is thought to indicate that nor-leucin is not a precursor of lysin and can not be substituted for lysin in the synthesis of body proteins for growth.

The effect of acids, alkalis, and salts on catalase production, W. E. Burge (*Amer. Jour. Physiol., 52 (1920), No. 2, pp. 364-376, figs. 2*).—In continuation of the catalase studies previously noted (E. S. R., 42, p. 259), the effect of organic and inorganic acids, alkalis, and salts on catalase production in rabbits and dogs was studied by the usual methods.

The introduction of sodium carbonate and phosphate, organic acids, such as acetic, propionic, butyric, and various amino acids, caused increased oxidation, attributed by the author to an increase in catalase. The administration of an inorganic acid such as hydrochloric caused a decrease in oxidation in the case of the rabbit and in increase in the case of the dog. The decrease in the former case is attributed to a decrease in catalase brought about by the inhibiting effect of the acid and by the direct destruction of the enzym, while the opposite results in the case of the dog are attributed to an increase in catalase

creatized animals. "An elevation of the threshold seems to be connected particularly with severity of the diabetes, but a teleological interpretation of this as a protective mechanism for saving sugar to the body is considered improbable."

Intestinal obstruction.—A study of the influence of the bacterial flora on the toxemia of acute obstruction, P. R. CANNON and L. R. and C. A. DRAGSTEDT (*Jour. Infect. Diseases, 27 (1920), No. 2, pp. 139–144*).—Evidence is presented by means of experimental work with rats that the toxemia incident to acute intestinal obstruction is uniformly associated with the presence of a proteolytic intestinal flora, whatever the nature of the flora before the obstruction is produced. While it is not possible to prevent the onset of toxemia in acute intestinal obstruction by feeding diets tending to produce an aciduric intestinal flora, the onset of the toxemia may be delayed in proportion to the degree that aciduric flora may be maintained.

On the investigation of gastric function by means of the fractional test-meal, J. A. RYLE (*Lancet [London], 1920, II, No. 10, pp. 490–492, figs. 9*).—This report consists of an abridged account of the technique of the Rehfuss fractional method of gastric analysis, reproductions of specimen charts illustrating physiological and pathological phenomena, and a summary of the advantages of this method of gastric analysis.

Energy expenditure in household tasks, C. F. LANGWORTHY and H. G. BAROTT (*Amer. Jour. Physiol., 52 (1920), No. 2, pp. 400–408*).—"Fifty-three experiments on energy elimination during the performance of various household tasks were made, using a specially designed respiration calorimeter and a young woman subject. The results for such light tasks as sewing, crocheting, knitting, darning, and embroidering gave an average expenditure of 9 calories per hour more than that of the same subject sitting quietly in a chair; other tasks regarded as 'harder work' than sewing, such as washing, sweeping, and scrubbing floors, caused an increased energy expenditure over the expenditure when at rest with the same subject of about 50 calories per hour. Several other tasks studied gave results between these two figures: Thus ironing, dressing a child (life-size model), and dishwashing each requiring about 24 calories per hour.

"During the experiment with dishwashing the height of the table used was varied, and a corresponding variation in energy expenditure was noted, a variation of 15 per cent in height of table causing an increase in energy expenditure of 20 to 40 per cent. The observed increase of heat elimination well illustrates the importance of choosing equipment to 'fit' the worker."

ANIMAL PRODUCTION.

An introduction to the study of cytology, L. DONCASTER (*Cambridge, [England]: Univ. Press, 1920, pp. XIV+280, pls. 24, figs. 31*).—This volume covers the general field of animal cytology with particular reference to the maturation of the germ cells, the problem of the fertilization and segmentation of the egg, the basis of sex determination, the theory of the individuality of the chromosomes, and the mechanism of hereditary transmission. It is an "introduction" only in the sense that previous knowledge of cytology is not assumed on the part of the reader, for the treatment in many sections is detailed and comprehensive. The author has avoided the use of diagrams and has chosen his illustrations from original papers. There is a bibliography of over 200 titles.

Cytology, with special reference to the metazoan nucleus, W. E. AGAR (*London: Macmillan & Co., Ltd., 1920, pp. XII+224, figs. 92*).—This volume is

a comprehensive review of current ideas about chromosomes and their importance in sex determination and hereditary transmission.

Side-to-side v. end-to-end conjugation of chromosomes in relation to crossing over, W. NAKAHARA (*Science, n. ser., 52 (1920), No. 1334, pp. 82–84*).—The author points out that the occurrence of telosynapsis instead of parasynapsis in the germ cells prior to reduction does not preclude crossing over, since (in many forms at least) an opportunity for an interchange between chromosomes occurs during the pachytene stage of the reduction division.

Linkage in mice and rats, L. C. DUNN (*Genetics, 5 (1920), No. 3, pp. 325–343*).—The author reports breeding experiments which indicate (1) crossing over of 14.5 per cent between the genes for pink-eye and for albinism in mice and (2) a slight crossing over between red-eye and albinism in rats instead of the complete linkage found by Castle (E. S. R., 42, p. 762). Unpublished data by Castle are cited to show that crossing over between the pink-eye and the red-eye genes in rats is somewhat less frequent in the male than in the female, the difference being statistically significant. In mice, crossing over also occurs in the male, but there is a less certain indication of similar differences between the sexes.

Linked genes in rabbits, W. E. CASTLE (*Science, n. ser., 52 (1920), No. 1337, pp. 156, 157*).—The author reports breeding experiments with rabbits which indicate a linkage strength of 23 (i. e., a crossing over of 38.5 per cent) between the factor for intensity and the factor for the type of white spotting known as the English pattern.

Independent genes in mice, L. C. DUNN (*Genetics, 5 (1920), No. 3, pp. 344–361*).—From breeding experiments and examination of the literature, the author finds that three independent linkage groups in mice have been identified with certainty and notes two provisional groups. On the chromosome hypothesis there should be 19 of these groups in addition to the undiscovered sex linked group. The contention of Hagedoorn (E. S. R., 27, p. 769) that nonagouti and albinism are completely linked is not confirmed.

Note on the occurrence of a probable sex-linked lethal factor in mammals, C. C. LITTLE (*Amer. Nat., 54 (1920), No. 634, pp. 457–460*).—In an inbred strain of dancing mice the ratio of males to females was 53.2 : 100, whereas in an inbred normal strain the ratio was 103.1 : 100. To throw light upon the cause of the difference the author made experimental crossings between the strains. In the offspring of the mating dancing ♂ × normal ♀ the ratio was 118.2 : 100 and in the offspring of normal ♂ × dancing ♀ the ratio was 44 : 100. It is concluded that this result is adequately explained by postulating a sex-linked lethal factor, the first case of the sort reported for mammals.

Relationships between the age of parents and the cannon bone circumference of the offspring, C. WRIEDT (*Jahrb. Wiss. u. Prakt. Tierzucht, 11 (1917), pp. 187–205, figs. 6*).—Measurements of the cannon bone of horses are cited which indicate that if the parents are more than 10 years old the offspring have thinner cannon bones than the offspring of younger parents. "The cause of this weakening can be a pathological factor ('false' heredity), or the possibility exists that one or more hereditary factors develop with increased age of parents."

The body form of sterile twins in cattle, K. KELLER (*Jahrb. Wiss. u. Prakt. Tierzucht, 10 (1916), pp. 103–164, figs. 19*).—The author reports body measurements and observations on the development of 10 freemartins. Measurements of normal heifers, steers, and bulls are presented for comparison, and the castrated male twin of one of the freemartins was available for study. Murboden, Mariahof, and Mölltal breeds and Mariahof×Simmental crosses were represented among the freemartins.

The production of freemartins is considered essentially an intrauterine spaying. The internal genitalia of four of the freemartins were examined histologically and found to be poorly developed and devoid of germ cells. The freemartins were higher in proportion to body length than normal heifers and resembled spayed heifers in this respect. The increased height was due almost entirely to the lengthening of the long bones of the legs, particularly the metacarpus. The freemartins showed prominent withers resulting from the elongation of the spinous processes of the thoracic vertebrae, a slightly greater development of the horns, and characteristic peculiarities in the shape of the pelvis

An illustration is given of the common chorion in which one pair of twins was inclosed. The significance of such chorions has been pointed out by Tandler and Keller (E. S. R., 41, p. 672).

A respiration chamber for large domestic animals, F. G. BENEDICT, W. E. COLLINS, M. F. HENDRY, and A. JOHNSON (*New Hampshire Sta. Tech. Bul. 16 (1920), pp. 3–27, pl. 1, figs. 5*).—This description of an apparatus for measuring the carbon dioxid eliminated by large domestic animals is noted editorially in this issue. The formulas of Armsby, Fries, and Braman noted below are to be used for estimating the heat elimination.

The carbon dioxid: heat ratio in cattle, H. P. ARMSBY ET AL., J. A. FRIES, and W. W. BRAMAN (*Proc. Natl. Acad. Sci., 6 (1920), No. 5, pp. 263–265*).—Using data secured in 99 48-hour energy balance experiments with cattle in the respiration calorimeter of the Pennsylvania Institute of Animal Nutrition, the authors studied the ratio between heat produced and carbon dioxid eliminated as a function of the feed consumption and derived the formulas

$$y_1 = 14.176 + 0.869x,$$
$$y_2 = 4.365 + 0.455x, \text{ and}$$
$$y_3 = 2.802 - 0.0226x,$$

where x is the air-dry weight of feed in grams per kilogram of live weight, y_1 is the calories of measured heat per kilogram of live weight, y_2 is the grams of CO_2 per kilogram of live weight, and y_3 the ratio of calories to grams of CO_2. The values of x used in the experiments ranged from 5 to 27, no observations being available for the fasting animal. The y_3 equation seemed to give a closer fit to the observed data than the other equations, and it is concluded that this equation may be used with a good degree of accuracy for computing the heat elimination of cattle not performing work when the live weight and feed consumption are known and the production of carbon dioxid has been measured.

When $x=0$, $y_1/y_2=3.25$, and the authors are inclined to think that this will be found closer to the true ratio for fasting animals than the value 2.80 given by y_3.

When the data used above were divided into 24-hour periods and the observed ratios treated as a frequency distribution without regard to the amount of feed consumed, it was found that the values ranged from 2.15 to 3.15, with a mean of 2.4947 ± 0.0085 and a standard deviation of 0.17. The values were somewhat higher with standing animals than with those in a lying posture.

Maintenance and reproduction with grains and grain products as the sole dietary, E. B. HART and H. STEENBOCK (*Jour. Biol. Chem., 39 (1919), No. 2, pp. 209–233, pl. 1, figs. 12*).—The authors report experiments with calcium-poor rations for young rats and mature sows at the Wisconsin Experiment Station. The rat data are not treated in detail and are cited to show that single grain diets and distilled water result in decline in weight.

The 21 sows used had been fed during growth on rations containing alfalfa and varied in weight from 200 to 350 lbs. When ready for breeding they were

transferred to one of 10 experimental rations of cereal grains, mixed in some cases with peas, linseed meal, and grain by-products. Sodium chlorid formed 1 per cent of all but one of the rations, and the estimated average intake of calcium from the drinking water was equivalent to 1.1 gm. of CaO per head per day.

Rations of corn and peas, corn and oats, corn and gluten feed, or corn, oats, wheat middlings, and linseed meal maintained the weights throughout the first pregnancy; and the first-litter pigs were all born alive and were fairly healthy. Many of the pigs in the second litters, however, were stillborn, and the sows often assumed a staggering gait soon after parturition and some of them died. Complete physical breakdown of the sows was prevented in some instances by the addition of alfalfa hay to the ration.

Rations composed of corn, oats, or barley alone, of barley and wheat gluten (39:1), or of oats and linseed meal (17:3) were not adequate during the first pregnancy, stillborn pigs appeared in the first litters of sows fed each of these rations and in 7 out of 11 litters all the pigs were born dead. Staggering gait was common on the part of the sows.

It is held that lack of vitamins and roughage played minor parts in the experiments, and that the only characteristic common to the rations was a deficiency in calcium. As a working hypothesis the authors adopt the view of G. H. A. Clowes[1] that with a preponderance of sodium salts in the ration and a low amount of calcium salts the surface protoplasmic films of the epithelial cells of the intestinal mucosa form a structure in which water is the continuous phase. An increase in the calcium intake, on the other hand, would favor a protoplasmic condition in which fats and lipoids are the continuous phase.

"This hypothesis of intestinal protoplasmic structure, as influenced by the balance of sodium calcium salts in the diet, would pave the way for the view that on low calcium diets there would be especially favorable conditions for the continued absorption of products of intestinal origin, among which may be bacterial toxins or amins. Further, that an increased absorption of such products as mentioned would ultimately lead to physiological disturbances such as an undue stimulating effect on plain muscles as exhibited by certain amins: an undue stimulation to the central nervous system, causing tremors of the limbs and vasoconstriction: and an interference with the normal oxidative processes of the tissues leading to intoxication and asphyxiation."

Relation of plant carotinoids to growth, fecundity, and reproduction of fowls, L. S. PALMER and H. L. KEMPSTER (*Jour. Biol. Chem., 39 (1919), No. 2, pp. 299–312, pl. 1*).—The authors, working at the Missouri Experiment Station, report normal growth from hatching to adult life, normal egg laying, and normal fertility in White Leghorn chickens fed rations free or practically free of carotinoids. The scratch feed consisted of white corn and the mash of white corn meal, white corn bran, and bleached flour, while bone meal was fed ad libitum. In the first two experiments the only source of vitamins was separator skim milk, but apparently the amount of fluid milk which the chicks could consume was not sufficient, since normal growth did not continue beyond a few weeks. In the third experiment pig's liver was added to the ration and normal growth ensued. "A careful examination of pork liver showed no pigments to be present which were distinctly characteristic of carotin or xanthophyll, although considerable difficulty was encountered in handling the material due to the presence of bile and liver pigments." Later, in the attempt to secure absolutely colorless eggs for analysis and hatching, a ration of skim milk powder, corn starch, filter paper, and bleached butter fat was used.

[1] Jour. Phys. Chem., 20 (1916), No. 5, pp. 407–451.

The birds showed no pigmentation in the shanks, beaks, ear lobes, or eye ceres, and the secretion of the uropygial gland was colorless. Analyses of some of the carcasses indicated traces of carotinoids in the blood serum and adipose tissue due, it is thought, to newspaper used as roughage and to the feeding of rice flour for a short period. The yolks of the eggs laid by the hens were practically colorless, but a slight residual pigmentation was noticeable in the uncoagulated yolk. This pigment did not give tests for xanthophyll, nor was it possible to identify it with bilirubin or with Barbieri's ovochromin (E. S. R., 28, p. 607).

"In spite of the fact that the rations used can be said to have contained an irreducible minimum of carotinoids only, we feel entirely justified in concluding from this experiment that fowls can be raised from birth to maturity on rations devoid or containing mere traces of carotinoids provided the ration contains an adequate supply of growth-promoting vitamins. . . .

"The experiment also seems to point conclusively to the fact that the association of carotinoids and fat-soluble vitamin in certain plant and animal materials such as green leaves and butter fat, is probably fortuitous."

Chicks raised from the colorless eggs showed no surface pigments. They were vigorous at hatching and grew normally on the carotinoid free rations, but the mortality was high.

The physiological relation between fecundity and the natural yellow pigmentation of certain breeds of fowls, L. S. Palmer and H. L. Kempster (*Jour. Biol. Chem., 39 (1919), No. 2, pp. 313–330, pls. 2*).—White Leghorn chickens of the carotinoid-free flock noted above were used in a study of the influence of xanthophyll feeding on the surface pigmentation.

When cockerels from this flock were fed yellow corn the shanks and beak assumed a yellow color, but similar feeding of pullets did not result in surface color so long as egg production continued. Histological examinations were made of the epidermis of the ear lobes, beaks, and shanks of these birds and also of normal birds during the gradual fading resulting from carotinoid-free rations. Nile blue was found to color the xanthophyll granules blue and the fat red. The xanthophyll occurred chiefly in the Malpighian layer and also along the blood capillaries of the subcutaneous tissue, and had little or no fat associated with it. When the skin grows paler it was found that the pigment disappears from the exterior of the corium more rapidly than in the deeper skin layers.

It is concluded that in nonlaying birds xanthophyll is largely excreted through the skin. Egg laying merely deflects the path of excretion to the egg yolk and thereby removes the source of the skin pigment. The skin then fades through surface oxidation and sloughing. This view is contrary to the hypothesis expressed or implied in the publications of Kent (E. S. R., 33, p. 173: 35, p. 480; 38, p. 775) and of Blakeslee and collaborators (E. S. R., 33, p 172; 39, p. 74) that the pigment is withdrawn from the body surface with the fat by the blood stream and stored in the eggs.

In the authors' opinion the fading of the ear lobes, beak, and shanks of hens of the Leghorn and American breeds following egg laying is an index of continuous, rather than heavy, laying.

The influence of specific feeds and certain pigments on the color of the egg yolk and body fat of fowls, L. S. Palmer and H. L. Kempster (*Jour. Biol. Chem., 39 (1919), No 2, pp. 331–337*).—Some of the White Leghorn chickens raised on carotinoid-free rations were used in this study. It was found impossible to color the beaks, shanks, or ear lobes of the birds by feeding butter of a naturally high color made from the colostrum milk of a Jersey cow, while the feeding of yellow corn soon caused the appearance of yellow pigment. The

results, therefore, confirm a previous conclusion by Palmer[1] that xanthophyll and not carotin is used by fowls for the pigmentation of tissues. It was also found that the orange yellow pigment of the annatto seed is without influence on the color of the adipose tissue, and that Sudan III colors the adipose tissue of nonlaying birds only and does not color the visible skin parts.

The relative xanthophyll content of various feeds was determined by feeding them separately to hens laying eggs with xanthophyll-free yolks. Yellow corn and green feed are rich in xanthophyll and small amounts occur in hemp seed, barley, gluten feed, and red corn. Wheat, wheat bran, oats, cottonseed meal, rape seed, meat scraps, and blood meal contain only negligible quantities.

A bibliography of investigations bearing on the composition and nutritive value of corn and corn products, M. H. KEITH (*Washington, D. C.: Natl. Research Council, 1920, pp. XIII+178*).—This is a mimeographed bibliography noted editorially on page 4.

Analyses of feeding stuffs, M. O. JOHNSON and K. A. CHING (*Hawaii Sta. Rpt. 1919, pp. 42, 43*).—A table is presented giving the proximate composition of pigeon pea feed, coconut meal, alfalfa meal, Mung bean (*Phaseolus radiatus*) cane top meal, Brazilian velvet bean feed, sisal stump, and fibers from the pineapple plant and from the stump after starch extraction.

On hydrolyzed wood meal and its utilization, ELLENBERGER (*Illus. Landw. Ztg., 39 (1919), No. 9-10, pp. 33, 34*).—The author reviews some of the previous work on the use of hydrolyzed cellulose as a feeding stuff, and reports some experiments with work horses which indicate that hydrolyzed wood meal may not only be substituted for the hay of the ration but may also replace the oats if some supplemental protein is furnished.

Comparative feeding experiments with various grades of low moor, high moor, and mineral land hays, II, B. TACKE and W. FRECKMANN (*Ber. Landw. Reichsamte Innern, No. 39 (1916), pp. 24*).—The authors report feeding experiments with steers which show (1) that high moor hay is about 30 per cent more efficient than marsh hay, due it is thought to the higher protein content of the former, and (2) that greater gains were produced by low moor hay than by clover hay. There are also included tables giving the proximate composition of the hays and of sunflower cake fed as a supplement in one of the experiments, mineral analyses of the low moor and clover hays, and lists of the plants identified in the hays. Digestion trials with these hays were reported in the first paper of this series (E. S. R., 32, p. 363).

The beef calf: Its growth and development, E. W. SHEETS (*U. S. Dept. Agr., Farmers' Bul. 1135 (1920), pp. 32, figs. 24*).—The selection, feeding, and marketing of beef calves, and fitting for the show ring are described, particularly from the point of view of members of boys' and girls' clubs.

A comparison of some traits of conformation of Southdown and Rambouillet sheep and of their F_1 hybrids, with preliminary data and remarks on variability in F_2, E. G. RITZMAN and C. B. DAVENPORT (*New Hampshire Sta. Tech. Bul. 15 (1920), pp. 32, figs. 25*).—The authors present measurements of body dimensions of Southdown and Rambouillet ewes and F_1 and F_2 individuals of a Southdown×Rambouillet cross, for the purpose of studying the inheritance of body characters. The dimensions measured were height, depth of chest, lengths of foreleg, hind leg, head, neck, trunk, and croup, widths of head, chest, and loin, and girths of chest and hind leg. The tables give for each class of animals the mean and probable error of the measurement, range, standard deviation, and coefficient of variability. For the study of conformation most

[1] Jour. Biol. Chem., 23 (1915), pp. 261-279.

reliance is placed upon the ratio of dimensions. The following table presents data for the five ratios where the parent breeds differed noticeably. In addition to these the ratios of croup length, foreleg length, and chest depth to trunk length were studied.

Means and standard deviations of ratios (×100) of the body dimensions of the parent stock and the F_1 and F_2 of a Southdown×Rambouillet cross.

Class of stock measured.	Number measured.	Head width: head length.		Height: trunk length.		Chest width: chest depth.		Chest width: trunk length.		Loin width: trunk length.	
		Mean	S. D.	Mean.	S. D.	Mean.	S. D.	Mean.	S. D.	Mean.	S. D.
Southdown ewes	50	67.32	2.68	98.1	4.98	84.78	5.18	43.48	2 73	27.06	5.18
Rambouillet ewes	50	59.60	4.41	106.8	4.24	64.10	4.41	31.56	2.61	21.34	4.41
F_1 rams, yearling	36	66.60	4.52	105.6	7.31	65 93	4.81	32.97	3.15	22 83	4.81
F_1 ewes, yearling	36	68.38	5.46	106.2	4.95	67.44	5.06	32 97	2 02	22 91	5.06
F_1 ewes, mature	36	67.44	3.16	99.1	3.75	67.12	4.02	33.60	1.99	21 75	4.02
F_2 rams, yearling	14	68.57	3.64	103.9	4.30	61.75	5.43	31.50	3.18	21.82	5.43
F_2 ewes, yearling	19	65.81	2 43	106.0	3.37	64.15	3.60	32.36	1.89	22.50	3.60
F_2 ewes, mature	7	64.71	5 35	108.6	1.18	61.64	3.07	31.28	1.70	20.86	3.07

It is concluded that these data give definite evidence of dominance in the specific elements making up conformation. The low variability of the F_2 in comparison with the F_1 is not thought to indicate lack of segregation since the number of F_2 individuals thus far measured is very few.

Crossbreeding Delaine Merino ewes with purebred mutton rams, W. H. Tomhave and C. W. McDonald (*Pennsylvania Sta. Bul. 163* (*1920*), *pp. 19, figs. 8*).—This is a summary of the first four years' results of a practical crossbreeding experiment begun in the winter of 1915–16. Foundation stock consisted of 75 grade Delaine Merino ewes. The best 25 of them (lot 1) were used as a check and were mated to registered Delaine Merino rams, the female offspring being called lot 3. The remaining ewes (lot 2) were mated at first to a registered Shropshire ram and the ewe lambs produced (lot 4) were likewise bred to a Shropshire ram. Later Southdown rams were used on the lot 2 and some of the lot 3 ewes. After three mutton crosses it is planned to back cross on Delaine Merino for two generations.

The crossbred lambs gained more rapidly than the straight Merino lambs, but there was very little difference in growth and development between the Shropshire×Merino and Southdown×Merino. The crossbred ewes possessed a decided mutton conformation and averaged 129 lbs. as two-year-olds. The wool from the Merino ewes graded fine bleach to XX, while the fleeces of the Shropshire and Southdown rams graded quarter blood, and the wool from the crossbred ewes graded three-eighths to half blood. The lambing percentage of the crossbred ewes varied from 125 to 150, whereas the percentage in the case of the foundation stock was 100.

Distribution and development of German sheep breeding, G. Freyer (*Arb. Deut. Landw. Gesell., No. 292* (*1918*), *pp.* [*6*]+*539, pl. 1, figs. 6*).—This publication contains a wealth of statistical information concerning the status of sheep breeding in various political divisions of Germany.

The significance of sheep for meat production, M. Herter and G. Wilsdorf (*Arb. Deut. Landw. Gesell., No. 295* (*1918*), *pp. XVII+616, pls. 22, figs. 106*).—In this elaborate monograph the authors discuss the history of sheep breeding, breeds of sheep with reference to their mutton quality, the marketing of sheep, the production of wool, milk, and meat by sheep, the uses of mutton flesh and

mutton fat, the fertility of sheep, questions of feeding and management, the position of sheep in agricultural operations, and the sanitary requirements in sheep management.

Castrating and docking lambs, G. H. Bedell and E. W. Baker (*U. S. Dept. Agr., Farmers' Bul. 1134 (1920), pp. 14, figs. 9*).—The methods of castrating and docking lambs are set forth in a series of illustrations with descriptive text.

Feeding garbage to hogs, F. G. Ashbrook and A. Wilson (*U. S. Dept. Agr., Farmers' Bul. 1133 (1920), pp. 26, figs. 16*).—The general principles of managing hogs when garbage is the principal feed are outlined. Topics treated include collection and preparation of the garbage, methods of feeding, and sanitation. Analyses of garbage are included.

Care of mature fowls, A. R. Lee (*U. S. Dept. Agr., Farmers' Bul. 1105 (1920), pp. 8, figs. 4*).—Designed for the use of members of boys' and girls' poultry clubs.

Care of baby chicks, A. R. Lee (*U. S. Dept. Agr., Farmers' Bul. 1108 (1920), pp. 8, figs. 2*).—Designed for the use of members of boys' and girls' poultry clubs.

Culling for eggs and market, R. R. Slocum (*U. S. Dept. Agr., Farmers' Bul. 1112 (1920), pp. 8, figs. 5*).—Designed for the use of members of boys' and girls' poultry clubs.

The selection and care of poultry breeding stock, R. R. Slocum (*U. S. Dept. Agr., Farmers' Bul. 1116 (1920), pp. 10, figs. 6*).—Designed for the use of members of boys' and girls' poultry clubs.

Fattening poultry, G. R. Shoup (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 6, pp. 85–87, figs. 2*).—This is a general article on fattening poultry and includes a description of a homemade fattening crate.

DAIRY FARMING—DAIRYING.

A modification of the Haecker and Savage feeding standards for dairy cattle, A. C. McCandlish (*Jour. Dairy Sci., 3 (1920), No. 3, pp. 190–193*).—The modified standard is based upon two variables, crude protein and carbohydrate equivalent. The former is the average of the requirements called for on the Haecker and Savage standards, and the latter the average of the carbohydrate equivalents computed, respectively, from the carbohydrate and fat of the Haecker standard and the total digestible nutrients less the digestible crude protein of the Savage standard.

On the cause of changed milk yields following transfer from pasture to stall feeding, J. J. O. de Vries (*Verslag Ver. Exploit. Proefzuivelboerderij Hoorn, 1917, pp. 22–26*).—Eight cows, after being brought into the barn, were fed grass cut from the pasture previously occupied. The average milk yield in five days after the change was 23.3 per cent below the average daily yield in the four days preceding. The amount of fat was reduced 13.9 per cent, total solids 18.9, protein 26.3, and milk sugar 18.5 per cent. It is concluded that the drop was due to the change in living conditions and not to the character of the feed.

A note on the acidity of fresh milk, T. J. McInerney (*Jour. Dairy Sci., 3 (1920), No. 3, pp. 227–229*).—Breed averages of the titratable acidity of the milk of cows in the Cornell University herd were found to be as follows: Holstein 0.136, Jersey 0.162, Guernsey 0.139, Ayrshire 0.123, and Shorthorn 0.18 per cent. A much higher titratable acidity was found in milk from a near-by herd, and a chemical analysis showed that it contained unusually large amounts of ash and total solids. The abnormal composition is deemed a sufficient explanation of the acidity.

Police control of the milk trade in the interest of human health, R. von Ostertag (*Ztschr. Fleisch u. Milchhyg., 30 (1919), Nos. 1, pp. 1–3; 2, pp. 20–22;*

5, pp. 68–71; 7, pp. 98–104; 9, pp. 127–129; 10. pp. 139–141; 11. pp. 152–154; 12, pp. 161–164).—The author discusses some of the problems involved in the sanitary control of unpasteurized milk.

A study of factors concerned in the production of clean milk, I, E. G. Knight, K. Freear, and R. S. Williams (*London: P. S. King & Son, Ltd., 1920, pt. 1, pp. 8, pl. 1*).—Bacteriological investigations at Reading are reported to determine the value of the covered milk pail and the necessity of cleaning and clipping the cow's udder before milking. So long as the milk pails were washed by ordinary farm methods, milk collected in covered pails was more richly seeded than milk in the open pails. When the pails were sterilized the results were reversed. Even with the sterilized covered pail, the bacterial content was not satisfactory unelss the udder was washed prior to milking and the long hairs on the udder were clipped short.

A study of two types of commercial milk, K. Freear, W. Buckley, and R. S. Williams (*Cambridge [England]: Univ. Press, 1919, pp. 32, pls. 6*).—In this contribution from the Research Institute in Dairying, University College, Reading, records during 18 months are given of the shipping temperatures, bacteriological examination, and keeping quality of market milk shipped from two dairy farms. On one farm a consistent effort was made to secure the cleanliness of the cows, the milkers, and the utensils, while on the other farm only ordinary care was used.

Although the clean milk was from 22 to 26 hours old at the time of the examination, the bacterial counts of 70 samples were all, with two exceptions, less than 10,000 per cubic centimeter, and lactose fermenting organisms were present in only 8 samples. The milk from the farm where only ordinary care was given was examined within 4 to 13 hours after collection, and there were only 24 of the 71 samples in which the count was less than 10,000, while lactose fermenting organisms were present in 49 samples.

The carbon dioxid content as a basis for distinguishing heated from unheated milk, L. L. Van Slyke and R. F. Keeler (*New York Sta. Tech. Bul. 78 (1920), pp. 3–7; also in Jour. Biol. Chem., 42 (1920), No. 1, pp. 41–45*).—This is an investigation of the extent of the reduction of the carbon dioxid in milk brought about by pasteurization as reported in Technical Bulletin 69 (E. S. R., 43, p. 579).

It was found that the CO_2 content of milk is not appreciably affected by the method of milking; that it rarely drops below 3 to 3.5 per cent by volume when milk stands under ordinary conditions even for periods of 20 to 40 hours after milking; and that it is not appreciably changed by passing through a separator. Only extreme and prolonged stirring reduced the CO_2 below 3 per cent by volume, while heating milk under the conditions required for pasteurization reduced the CO_2 content to 2.5 per cent by volume or lower. "Therefore, it appears safe, in general, to assume that milk containing less than 2.5 or 3 per cent of CO_2 by volume has been heated to the temperature of pasteurization."

The bacterial flora of fresh and used bedding material, with particular reference to their influence on milk, R. Kürsteiner (*Centbl. Bakt.* [etc.], *2. Abt., 47 (1916), No. 1–9, pp. 1–191*).—This is a very elaborate investigation of the bacteria found on straw, "black litter" (material collected from meadows), foliage, sawdust, mill dust, and dried vegetation from peat bogs, both before and after their use by cows as bedding. A large number of species were isolated, and their ability to ferment fresh and sterile milk was studied.

The biology of Clostridium welchii, J. R. Esty (*Jour. Bact., 5 (1920), No. 4, pp. 375–429*).—This is a long study of the distribution, morphology, cultural characters, and pathogenicity of the gas gangrene organism, formerly called *Bacterium welchii*. The organism is present in practically all the market milk

of Providence, R. I., and it was found that contamination occurs after the milk leaves the udder. The thermal death points of the vegetative forms vary from 56 to 63° C. in 15 minute's exposure. The spores from two distinct groups, one with a thermal death point at 87 to 90° and the other surviving exposure to 100°. See also the recent paper of Ford (E. S. R., 42, p. 875).

A contribution to the knowledge of slimy decomposition of food stuffs, H. MAGNUSSON (*Centbl. Bakt.* [*etc.*], *2. Abt., 48 (1918), No. 20–23, pp. 459–469, figs. 4*).—The author investigated an outbreak of ropy milk on a dairy farm near Stockholm, and found that the causal organism was a saprophyte on the moldy hay which was being fed. In its cultural and morphological characters, which are described in detail, the organism resembled *Bacterium lactis viscosum* Adametz.

Brief mention is made of a case of slime production in sausage, but attempts to isolate the causal organism were unsuccessful.

Fishy flavor in butter, J. T. CUSICK (*Jour. Dairy Sci., 3 (1920), No. 3, pp. 194–205*).—This is a more extended treatment of the inoculation experiments noted in Memoir 30 of the New York Cornell Experiment Station (E. S. R., 43, p. 469).

Does the fat influence the water content of cheese? J. J. O. DE VRIES (*Verslag Ver. Exploit. Proefzuivelboerderij Hoorn, 1917, pp. 30–33; abs. in Zentbl. Agr. Chem., 49 (1920), No. 2, p. 80*).—Analyses of cheeses are presented, indicating that when conditions are comparable the ratio of casein to moisture is lower in whole milk cheese than in skim milk cheese.

The two types of Gouda cheese and Edam cheese, L. FUNDER (*Stat. Meieriforsøk Beret., 8 (1919), pp. 32, figs. 10; abs. in Mælkeritid., 32 (1919), Nos. 38, pp. 607–613: 39, pp. 627–635: Molk. Ztg. Berlin, 29 (1919), No. 46, pp. 267–269*).—This is a study of the large-holed and small-holed types in relation to their chemical composition, the acidity developed, and the details of manufacture. It was found that the production of large holes is due not only to the formation of gas, but to the increased moisture content characteristic of the large-holed type.

The normal gas formation in Edam cheese and Gouda cheese, F. W. J. BOEKHOUT and J. J. O. DE VRIES (*Centbl. Bakt.* [*etc.*], *2. Abt., 48 (1918), No. 5–9, pp. 130–139, fig. 1*).—The authors succeeded in isolating the bacterium responsible for the production of the round holes in Edam and Gouda cheese and studied its cultural and morphological characters. Milk was not a good culture medium, but the organism utilized peptone as a source of nitrogen and calcium lactate as a source of carbon. Holes were usually absent in experimental cheeses made from pasteurized milk inoculated with pure cultures to which potassium nitrate had been added. In normal cheeses the organism attacks the calcium lactate produced by the lactic fermentation and liberates hydrogen and carbon dioxid which produce the holes and cracks.

Cottage cheese and buttermilk cheese: Their manufacture and sale, J. L. SAMMIS (*Wisconsin Sta. Bul. 315 (1920), pp. 16, figs. 8*).—Directions are given for the manufacture of cottage cheese and buttermilk cheese, with brief notes on marketing.

A score card for city ice cream plants, W. P. FABIAN (*Jour. Dairy Sci., 3 (1920), No. 3, pp. 230–235*).—A score card is proposed for ice cream plants, in which 36 points are allowed for building equipment, 4 points for laboratory equipment, 14 points for sanitation of building, and 46 points for cleanliness of apparatus and methods of handling and inspecting the product.

California State dairy laws as amended, 1919 (*Sacramento, Calif.: State Dept. Agr., Div. Anim. Indus., 1919, pp. 48*).—This includes the act of 1911 deal-

ing with the production and standardization of dairy products, together with amendments and laws passed subsequently and court decisions.

VETERINARY MEDICINE.

The seventh and eighth reports of the director of veterinary research, 1918 (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp. [3]+734, pls. 40*).—The papers presented in this report include 9 articles abstracted below and the following: Geel Dikkop in Sheep (*Tribulosis ovium*) (pp. 1–55), Jagziekte in Horses (*Crotalariosis equorum*) (pp. 57–103), Dunziekte in South African Horses (Enzootic Liver Cirrhosis) (pp. 105–177), Nodes and Nodules in the Lungs of South African Equines (pp. 179–336), Paralysis of the Oesophagus in the Horse as a Sequel to Horse-sickness (pp. 337–357), and Observations on an Epizootic Contagious Catarrh of the Respiratory Organs of Equines and Its Relation to *Purpura hemorrhagica* (pp. 359–393), all by A. Theiler; The Value of the Complement Fixation Test in the Routine Diagnosis of Glanders (pp. 578–584), by E. M. Robinson; and Anoplura from South African Hosts (Part II) (pp. 707–734), by G. A. H. Bedford.

Germ-free filtrates as antigens in the complement fixation test, W. S. Gochenour (*Jour. Agr. Research [U. S.], 19 (1920), No. 10, pp. 513–515*).—Data obtained at the Bureau of Animal Industry, U. S. Department of Agriculture, are reported which indicate that a blackleg germ-free filtrate, produced under favorable conditions, possesses a distinct antigenic value demonstrable by the complement fixation test. Since blackleg filtrates which have been proved to confer immunity on calves were found to possess a high antigenic titer, the complement fixation reaction is recommended as a laboratory control test to determine whether the filtrate has been produced under conditions favorable to the blackleg organism or whether it has been contaminated by other anaerobic organisms. Failure of a blackleg filtrate to possess an antigenic titer of from $\frac{1}{10}$ to $\frac{1}{20}$ of the anticomplementary dose is considered evidence of contamination.

The specificity of such a reaction is also shown by the fact that good fixations were obtained by using *Bacillus botulinus* (type B) filtrate with *B. botulinus* (type B) immune serum, while no fixation occurred with type B filtrate and type A serum or with type A filtrate and type B serum.

"The phenomenon of germ-free filtrates acting as antigens in the complement fixation test is new and promises to play an important part in the differentiation of the spore-bearing anaerobes, more especially those having closely similar cultural characteristics."

A preliminary note on the toxic effect of methylene blue, G. van de W. de Kock (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp. 677–685*).—"Both sterilized and unsterilized solutions of methylene blue, when injected intrajugularly into six horses in sufficiently large doses, caused fairly acute symptoms of anemia, resulting in the death of two horses; but in the case of one horse, this toxic anemia was complicated with purulent nephritis, probably due to the same organism as that described by K. F. Meyer. . . . Of the three cattle injected intrajugularly with methylene blue solution [500 cc. 1 per cent], one died immediately after the injection, probably due to shock, whereas the other two showed symptoms of toxic anemia, rather more acute in the one, and resulting in the death of the animal. Of the eight sheep injected intrajugularly with methylene blue solution [100 cc. 1 per cent], four died shortly after the injection, probably due to shock, whereas four showed symptoms of anemia, rather more acute in the one, and resulting in the death of the animal."

Some experiments on the fate of arsenic in the animal body, H. H. Green and C. D. Dijkman (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp.*

687–698).—In experiments carried on to determine the fate of arsenic in the animal body, as takes place when animals are dipped in arsenical preparations, the results show that "1 gm. As_2O_3 as sodium arsenate, rapidly absorbed into the blood-stream, may easily prove fatal for the horse, although occasional horses can stand considerably higher amounts. When administration is oral the results are uncertain. For horses of medium weight, 1 gm. may kill, 2 gm. is very likely to kill, and 3 gm. is generally certain. We have one case on record, however, in which a drench containing 6 gm. As_2O_3 as arsenite was given by the mouth with no apparent ill effect. When intravenous injection is adopted there is no ambiguity about the absorption, and 1 gm. As_2O_3 as arsenite (about 2.5 mg. per kilogram), usually proves fatal on the day of administration, sometimes within a few hours. One horse, indeed, showed marked symptoms of intoxication (nonfatal), after so small an injection as 0.3 gm., while another showed less marked symptoms and recovered after an injection of 2 gm. Individual idiosyncrasy can, therefore, play a considerable rôle.

"In regard to arsenious oxid it is interesting to note that one horse was dosed with 1 gm. of the powder, and another with 2 gm. of the powder, every day for a fortnight without being any the worse for it. Another horse received 4 gm. daily and died by the time 24 gm. had been administered. A fourth received 5 gm. twice weekly and died after the fourth dose. It seems not improbable that moderately large doses repeated daily would be more toxic than the same total amount administered in one big dose, since by repeated administration the alimentary tract would be afforded no opportunity of freeing itself from the slowly soluble powder. This, of course, would not hold for repeated administrations of definitely subtoxic doses either of arsenious oxid or sodium arsenite, and the question of 'acquired tolerance' would then enter.

"In experimental work on sheep [E. S. R., 41, p. 873] it was found that death was uncertain with anything less than 0.5 gm. As_2O_3 as arsenite (10 mg. per kilogram) administered orally, or 0.3 gm. (6 mg. per kilogram) intrajugularly. In most cases 0.2–0.3 gm. is safe by the mouth (5 mg. per kilogram) and, as the experience with 'wireworm remedy' shows, 0.1 gm. (2–3 mg. per kilogram) can be safely administered medicinally in dosing flocks against *Hæmonchus contortus*. [Also,] 0.1 gm. has been injected intrajugularly in over half a dozen different cases without symptoms of intoxication being shown, and three sheep were injected with 0.2 gm. without disaster. [However,] 0.3 gm. injected intrajugularly was rapidly fatal in two cases, but nonfatal in a third, although symptoms of intoxication were shown.

"From the limited data at disposal for cattle, 1 gm. (2 mg. per kilogram), appears moderately safe by intrajugular injection, while 2 gm. is uncertain—some animals tolerating it and others succumbing on the day of injection. Effects of oral administration of soluble arsenic are more erratic with cattle, owing partly to idiosyncrasy and partly to the fact that the dose may pass direct to the abomasum in one case, and indirectly through the rumen in another. In the former case the arsenic reaches the intestine sooner and is more rapidly absorbed; in the latter the dose may be diluted down in the rumen and passed on for absorption much more slowly."

Behavior of bacteria toward arsenic, H. H. GREEN and N. H. KESTELL (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp. 699–706*).—"Differences in tolerance of different bacteria for arsenic are very marked. Many which are fairly tolerant of arsenate are relatively sensitive to arsenite. Certain groups are characteristically sensitive, e. g., the subtilis group, of which the four leading representatives were tested and all found intolerant of 0.05 per cent of As_2O_3 as sodium arsenate in broth. Other groups, notably the putidum family, can tolerate from 10 to 20 times this concentration, some mem-

bers growing freely in 1 per cent arsenite broth. The colon-typhoid group is sensitive as a family, but has at least one outstanding exception in *Bacterium arsenreducens*, and other resistant members probably exist. Resistance to arsenic is, therefore, not a rigorous group characteristic, although it is probably as characteristic as any other biochemical feature and might find a place in diagnostic bacteriology. Apart from the members of the putidum group five highly resistant bacteria (i. e., nonsporulating rod forms) are described, but not named.

"Of four cocci tested three were found sensitive and one tolerant. Two members of the streptothrix group were both sensitive. Yeasts and molds generally show a high degree of tolerance.

"Although over a dozen arsenic resistant species of bacteria were examined, only two showed any chemical activity toward arsenic; the earlier described *B. arsenoxydans*, which oxidizes arsenite to arsenate, and *B. arsenreducens*, which reduces arsenate to arsenite. The others were merely tolerant. There is no discernible relationship between arsenate reduction and nitrate reduction.

"Arsenite resistant bacteria are infrequent in soil but fairly frequent in feces. About 10 per cent of the bacterial count of fresh stable manure were found moderately tolerant, and about 1 per cent highly tolerant. In arsenical dipping tanks an automatic enriching of resistant fecal bacteria, and suppression (or metamorphosis?) of sensitive forms takes place."

Preparation of arsenical solution for dipping to destroy the cattle tick, F. A. López Domínguez (*Porto Rico Dept. Agr. and Labor Sta. Circ. 24 (1920), Spanish ed., pp. 12*).—Directions are given for the preparation of the arsenical dip.

A condition produced in cattle feeding on maize infected with Diplodia zeæ, D. T. Mitchell (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp. 425–437*).—The author concludes "that a disease in cattle characterized by incoordination of movement and paralysis is set up by feeding on mealie cobs which are infected with *D. zeæ*. Cultures of *D. zeæ* grown on sterile maize when fed produce clinical symptoms indistinguishable from those set up by feeding on infected cobs. The intensity of the symptoms and the mortality depend upon the quantity fed and on the percentage of infection present in the grains. Cultures of allied species of fungi grown on maize are incapable of setting up similar clinical symptoms. The causal factor is not the fungus itself, but must be looked for in the material which is formed as a result of the interaction of *D. zeæ* during its development in the starchy content of the maize grains."

A brief description of the disease as it occurs under veld conditions is given.

The effects produced on cattle by feeding on Paspalum dilatatum infected with a species of ergot, Claviceps paspali, D. T. Mitchell (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp. 439–449*).—"The feeding of cattle in the laboratory on heads of Paspalum infected with ripe sclerotia of *C. paspali* produces systemic disturbances indicated by hyperæsthesia and incoordination of movements, which are identical with those noted in animals feeding naturally on infected Paspalum lands. The symptoms appear rapidly after a meal of infected heads, and recovery is very slow. The absence of abortion in pregnant animals in naturally contracted cases is upheld by the experiments. One meal of 9 lbs. of Paspalum heads which show a fairly high degree of infection is sufficient to produce well-defined symptoms. The minimum quantity of pure sclerotia required to produce symptoms which could be recognized clinically is about 8 oz. Inoculation in one case of an extract of the sclerotia produced only a transient thermal reaction. Recovery is the rule,

and should occur even without medical treatment if animals are removed from the infected lands on the first appearance of the symptoms. Ulceration and necrosis, which are the rule in ergotism produced by *C. purpurea*, do not occur with *C. paspali*."

Some observations in connection with the occurrence of Sarcosporidia in the skeletal muscles of sheep and horses in South Africa, J. WALKER (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp. 395–424*).—Sarcosporidial cysts were found in 26 of the 27 sheep examined, the exception being a six weeks' old lamb. No sarcosporidial cysts were observed in three of the 26 horses examined. The greatest number of cysts found in section of the . . . skeletal muscles of a sheep was 331, and the greatest number of cysts observed in a section was 40 . . . With the exception of two instances in which a fatty degeneration of the skeleton muscles was observed . . . no degenerative changes were found in the skeletal muscular tissue, and no pathological changes were observed in the peripheral nerves. An edematous condition of the intermuscular connective tissue was found in some instances in sheep in poor condition. The symptoms described as characteristic in sheep affected with 'scrapie,' such as pruritis, loss of wool, and loss of muscular power, were not observed; the poor condition observed, in some instances, was associated with worm infection (*Strongylus contortus* and *Œsophagostomum columbianum*).

"The greatest number of cysts found in sections of the . . . muscles of a horse was 45, and the greatest number observed in a section was seven . . . A fatty degeneration was observed in the muscles of horses dying from horse sickness and pernicious anemia, piroplasmosis, and toxemia, the degeneration in these cases being attributed to the effect of the toxins produced by these diseases; in some instances the intermuscular tissue was edematous (horse sickness cases). No changes were noted in the peripheral nerve, with the exception of three horses affected with dourine, in which a neuritis was found to exist. Horses affected with dourine showed little or no sarcosporidial infection. Symptoms characteristic for lamziekte in cattle were not observed in the sheep and horses from which the muscular and nerve tissues were collected and examined."

On Sarcosporidia in relation to lamziekte, P. R. VILJOEN (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp. 451–576, pls. 5*).—The author reports upon the results obtained as to Sarcosporidia in 50 animals dead from lamziekte and 50 animals dead from other causes, most of the data being presented in tabular form. "In not a single case could direct evidence be produced to show that the cause of the disease was in any way connected with the presence of Sarcosporidia in the muscles of the lamziekte animals."

Hog cholera, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 21 (1920), Spanish ed., pp. 11, figs. 7*).—A general discussion.

Effects of pork-curing processes on trichinæ, B. H. RANSOM, B. SCHWARTZ, and H. B. RAFFENSPERGER (*U. S. Dept. Agr. Bul. 880 (1920), pp. 37*).—This is a report of investigations prior to which little was known concerning the effects of processes used in curing pork upon the vitality of trichinæ (*Trichinella spiralis*). It is pointed out that the Federal meat inspection regulations provide that products cooked in establishments under inspection must meet with requirements which insure the destruction of trichinæ; and that products containing any raw muscle tissue of pork, if of a kind prepared customarily to be eaten uncooked, must be subjected either to sufficient heat to destroy the vitality of any trichinæ, or to other processes sufficient to destroy their vitality. Investigations relating to destruction of their vitality by refrigeration and by heat have been previously noted (E. S. R., 34, p. 680; p. 684). The data

here reported, much of which are presented in tabular form, have led to the following conclusions:

"Pork products of kinds customarily eaten without cooking may be rendered safe for consumption, so far as the dangers of trichonisis are concerned, by certain curing processes. No single formula can be applied to all such products, as different ones require different treatments, depending largely on their size and on whether they are smoked.

"Sausages of moderate sizes have been rendered innocuous by the admixture of salt to the meat (not less than 3½ lbs. of salt per hundredweight of meat) followed by preliminary curing and then by drying. A minimum period of 25 days for the duration of these processes from the time the salt is added to the meat has been adopted as meeting the requirements for the destruction of trichinæ in unsmoked sausage. Of the 25 days at least 20 days must be devoted to drying at temperatures not lower than 45° F. In the case of certain sausages known as pepperoni, which are stuffed in narrow, thin casings, it was found feasible to reduce the curing period to 20 days, of which at least 15 days must be given to drying. [In each case] this allows 5 days for preliminary curing, which may be curtailed provided the time in the drying room is correspondingly increased."

Smoked sausage "is rendered innocuous by being subjected to a preliminary cure and then smoked at temperatures ranging around 80° for 40 hours, followed by drying for 10 days at temperatures not lower than 45°. Including the preliminary curing period, the sausage is held under supervision for 18 days from the time the salt is added to the meat. Sausage smoked at temperatures ranging from 125 to 130° for a relatively brief period following a preliminary curing period of at least 6 days is rendered innocuous without subsequent drying. Specifically the smoking period lasts 12 hours, of which 4 hours are devoted to bringing the temperature up gradually to at least 128°. During the next 4 hours the temperature is maintained at 128° or higher, and during the remaining 4 hours it is allowed to go down gradually to a point not below 90°. Sausage smoked for 6 hours at a temperature of about 100° followed by 10 days of drying was not rendered innocuous. This procedure is accordingly not recognized by the Bureau as meeting requirements for the destruction of trichinæ in sausage.

"Hams are rendered innocuous by the following methods: (1) The products are cured by means of dry salt (4 lbs. of salt per hundredweight of meat) for at least 40 days at a temperature not lower than 36°, and then smoked or pale-dried for 10 days at a temperature not lower than 95°; or (2) the products are cured on the basis of 3 days' cure for each pound of weight of individual hams, followed by 48 hours of smoking at a temperature not lower than 80° and finally by 20 days' drying at a temperature not lower than 45°.

"Products known as coppa are rendered innocuous by dry-salt curing for 18 days (4½ lbs. of salt per hundredweight of meat with the addition of small quantities of pickle solution) at temperatures not lower than 36°, followed by drying for at least 35 days at a temperature not lower than 45°. Products known as capicola are rendered innocuous by 25 days of curing under conditions similar to those used in preparing coppa, followed by 20 hours of smoking at a temperature not lower than 80°, and finally by 20 days' drying at a temperature not lower than 45°. No method has yet been discovered for rendering lockschinken innocuous by means of curing without affecting the quality of the product.

"The factors which appear to exert injurious influences on trichinæ in the course of curing are salt and temperature. The former gradually undermines

the vitality of the parasites, probably by withdrawing water from their tissues and also perhaps by exerting upon them a direct toxic action. Salt furthermore lowers the resistance of the larvæ to heat and thus renders them susceptible to temperatures which normally would not prove fatal. The temperature employed during smoking or pale-drying in most of these experiments were by themselves too low to injure seriously the parasites, but the combined action of salt and temperature was efficacious in destroying the vitality of the larvæ. Drying is also a decided factor in bringing about the destruction of the trichinæ, apparently because the evaporation of moisture from the meat increases the concentration of the salt in addition to other possible injurious effects which it may exert."

Dourine of horses, J. R. MOHLER and H. W. SCHOENING (*U. S. Dept. Agr., Farmers' Bul. 1146 (1920), pp. 12, figs. 5*).—A popular summary of information on dourine, including the history of early outbreaks, cause and transmission, symptoms, post-mortem lesions, course and outcome of the disease, diagnosis including directions for collection of blood serum for laboratory diagnosis, treatment, and method of eradication.

Further observations on the disease equine pernicious anemia, G. VAN DE W. DE KOCK (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp. 581–636*).—A continuation of investigations by Theiler and Kehoe, previously noted (E. S. R., 35, p. 678), has led the author to draw the following conclusions:

"Pernicious anemia of equines is of great economic importance in the immunization of horses against horse sickness. Great difficulty was always experienced in definitely diagnosing the disease when it made its appearance, or when it was suspected during or after the immunization of horses against horse sickness. The only positive method of diagnosis, blood inoculation, could not always be relied upon, especially when the result of the test turned out to be negative.

"It appears that pernicious anemia of equines is not so very prevalent in the Union of South Africa as was at one time suspected. From the information on hand it is impossible to say what the distribution is. The disease is not yet generally recognized, and it is in many cases most probably mistaken for biliary fever and other diseases. From the records on hand it appears that the disease already occurred here in 1904, and from then onward a number of cases followed. The percentage of natural cases admitted seems to be extremely small, less than 0.05 per cent, and cases due to treatment less than 0.4 per cent.

"There are a number of secondary reactions after treatment, such as post-horse-sickness reactions, reactions after hyperimmunization, and bleeding, etc., which might be easily mistaken for pernicious anemia. Moreover, it is impossible to say to what extent nonspecific temperature reactions and other symptoms (such as subcutaneous edema, emaciation, changes of the conjunctival mucous membranes, etc.), and indefinite, nonspecific pathological anatomical appearances so often observed, are really caused by the filterable inoculable virus of equine pernicious anemia. It was impossible to accuse conclusively any particular virus or serum as a source of infection in the majority of those cases after treatment.

"To exclude pernicious anemia contamination from horse-sickness viruses to be used for immunization of horses, it is suggested that the following be adopted in the preparation of these viruses until a simpler method of diagnosis is devised: (*a*) To select for 'bleeders' fairly young horses in good condition, keep them under observation for at least a month, and if no symptoms suspicious of pernicious anemia are observed, then they can be utilized; (*b*) their

blood should be controlled in at least three other horses before injection with the horse-sickness virus; (c) after the virus has been taken from such horses it should again be tested on at least three susceptible horses as regards its horse-sickness virulency, and at the same time to ascertain whether it is free from pernicious anemia. Should the virus so prepared be of the virulent horse-sickness type instead of the attenuated, then the latter test need be carried out on immune horses instead of susceptibles. To exclude pernicious anemia contamination from anti-horse-sickness serum to be used for the immunization of horses, it is suggested that all serum be stored for at least one year. Storing for three years did not cause any depreciation in the value of the serum. The other method, viz, heating, does not seem to be practical; heating virulent serum for 24 hours at 45° C. does not seem to have the effect of destroying the virus.

"Besides the symptoms described in the 1915 report, bleeding from the nostrils and skin, and symptoms of staggers have also been observed in a few acute cases prior to death. The conclusions drawn by Theiler and Kehoe, viz, 'that the results they obtained do not allow them to regard the bone marrow of animals dying from pernicious anemia as presenting any special characteristic appearance, since exactly similar appearances are to be met with in animals coming to autopsy as a result of death from a large variety of causes,' were again confirmed.

"Pernicious anemia serum does not yield uniform results, i. e., it may or may not infect when injected into susceptibles. Infected serum of the same date and also of different dates did not always produce the disease. The infectivity with pernicious anemia blood seems to be more uniform when injected in sufficiently large doses. We are still at a loss to explain the capability of pernicious anemia viruses present in the blood or serum to produce the disease in certain horses, and not in others, although the latter are not virus carriers. As far as we know at present there is no such thing in pernicious anemia as a degree of virulency or difference in strain; not in one instance were we capable of producing the disease 'afresh,' or causing a 'relapse,' or 'breakdown in the immunity' in known virus carriers clinically recovered. It appears that the serum prepared from clinically recovered pernicious anemia horses, which were treated with great quantities of virulent pernicious anemia blood, acquires no therapeutic or curative properties.

"During the treatment of a number of pernicious anemia horses with certain drugs, especially arsenophenylglycin, fresh remissions of temperature or relapses were caused in horses, some of whom were regarded as clinically recovered. . . . From the evidence derived from a great number of horses in horse-sickness experiments, we came to the conclusion that contamination with pernicious anemia virus from horse (virus carrier) to horse at the time of injection, might be considered a possible way of spreading the disease during immunization. . . . The various drugs used did not appear to exercise any appreciable effect on the course of the disease."

Drug treatment in nuttalliosis, G. VAN DE W. DE KOCK (*Union So. Africa, Dir. Vet. Research Rpt. 7–8 (1918), pp. 637–675*).—Work with nuttalliosis, the type of biliary fever in equines most commonly met with in South Africa, is reported, the details being given in tabular form.

The divergent opinions of the different investigators as to the success of certain drugs in the treatment of nuttalliosis is ascribed to confusing the disease with certain forms of pernicious anemia; the existence of different strains of the type Nuttallia, some being less virulent than others, and therefore less resistant to some of these drugs, or very likely in South Africa to the treatment of *Piroplasma caballi* instead of the more virulent type Nuttallia. "For the

present it is suggested that quinin hydrobromid be utilized for mild cases of Nuttallia as soon as these are detected, and that further experiments with the drugs which have not yet been tested, such as carbolic acid, eucalyptus, etc., be carried out on the more severe cases."

Sorehead or chicken pox and poultry canker, L. M. Ross (*Hawaii Sta. Rpt. 1919, pp. 54, 55*).—In dealing with chicken pox, which in the past has been the most serious drawback to poultry raising in the islands, it was found that prompt isolation of suspects, careful attention to sanitary conditions, and one or two treatments of the heads of quarantined birds with some suitable antiseptic resulted in reducing the loss to negligible percentages. In an advanced stage of the affection calcium sulphid, at the rate of one teaspoonful of the powder per day for 25 hens, administered in a moist mash, has some curative effect.

In the control of poultry canker, which is very common in Hawaii, the ulcer and the surrounding flesh, both inside and outside the mouth, must be painted with tincture of iodin immediately after the canker has been firmly compressed from the outside of the mouth. The beak and nostrils of the affected chicken should be dipped for a few seconds in kerosene, and repeated three or four times, followed by the administration of a grain capsule of quinin.

Common poultry diseases, D. M. GREEN (*U. S. Dept. Agr., Farmers' Bul. 1114 (1920), pp. 8, figs. 2*).—This is a popular account of gapes, roup, chicken pox, and scaly leg, intended especially for members of boys' and girls' clubs.

RURAL ENGINEERING.

Supporting strength of drain tile and sewer pipe under different pipe-laying conditions, W. J. SCHLICK (*Iowa Engin. Expt. Sta. Bul. 57 (1920), pp. 68, figs. 32*).—Investigations are reported which were undertaken primarily to determine by actual tests the relation of the ordinary supporting strength, as given by standard laboratory tests, to the supporting strengths developed by pipe under ordinary pipe-laying conditions, to determine the definite ratios thereto of the supporting strengths developed with other pipe-laying methods, and to determine the most economical methods of increasing the supporting strengths of pipe.

The pipe used were classed as hard-burned shale and varied in size from 18 to 36 in. Pipe were placed in actual shallow trenches under different pipe-laying conditions and loaded to cracking in all cases, and to complete collapse in all but a few instances. It was found that the foundation area to which the load on the pipe is transmitted and the uniformity of the distribution of this pressure have a marked effect upon the supporting strength of the pipe. A high supporting strength was found to require a wide and uniform distribution of the pressure between the pipe and the bed upon which it rests.

It is considered both practicable and desirable to group pipe-laying methods into classes. Methods of laying in earth are classed as ordinary, first-class, and impermissible. The ordinary class is that in which the underside of the pipe is carefully bedded in soil for from 60 to 90° of the circumference. The first-class method is that in which the underside of the pipe is very thoroughly bedded in soil for at least 90° of the circumference. The impermissible methods are those in which the bottom of the ditch is not suitably rounded to fit the underside of the pipe. Pipe-laying methods in sand and gravel should be of the first-class type, but their use is restricted to cases where hub-and-spigot sewer pipe are used and the joints filled. Concrete cradle pipe-laying methods are classed as combined earth and concrete cradle, concrete cradle for any soil, concrete cradle for firm soil, and concrete cradle for yielding soil.

The investigations showed that the side support or resistance to horizontal thrust obtainable in most soils is of little value in increasing the supporting strength of the pipe before cracking. When pipe were incased in concrete the pipe and the concrete acted as a unit in resisting the deformation due to the load upon the pipe, thus increasing the supporting strength. The supporting strength of a cracked pipe was found to depend on the bearing power of the soil at the sides, irrespective of the method of pipe laying and upon the length of the time of continuous application of the maximum load. The presence of concrete at the sides of the pipe provided a wider distribution of the side pressure, and in some soils resulted in a high supporting strength for a cracked pipe. The supporting strength of drain-tile and sewer pipe laid by the ordinary method is concluded to be the rational basis from which to calculate the supporting strength of the same or similar pipe under any pipe-laying condition. The safe supporting strength using a factor of safety of drain-tile or sewer pipe is concluded to be the supporting strength before cracking. The supporting strength after cracking was found to depend upon the bearing power of the soil, which may change under any of several conditions. It is concluded that a factor of safety of one and one-half is both necessary and sufficient to prevent cracking. Thus the average supporting strength of the pipe used should be one and one-half times the probable maximum load on the pipe.

Tests of the particular pipe-laying methods outlined showed that the supporting strength developed by drain-tile and sewer pipe laid by the ordinary method is equal to the average ordinary supporting strength of the same or similar pipe as determined by the standard strength test using sand bearings The first-class method of pipe laying was found to increase the supporting strength from 20 to 25 per cent, while the supporting strength developed by pipe laid by the impermissible methods was only about 80 per cent of the ordinary supporting strength as determined by standard test. The supporting strength developed by pipe bedded upon and surrounded by sand was found to be approximately equal to that developed by pipe laid by the first class method.

It is concluded that drain-tile should never be placed in beddings of this kind. It was also found that the supporting strength of drain-tile and sewer pipe can be increased from 50 to 100 per cent by the use of properly designed concrete cradles.

Short report on Nile gauge readings and discharges, H. E. HURST (*Egypt Min. Pub. Works, Phys. Dept. Paper 1* (*1920*), *pp.* [*II*]+*43*).—This report contains the results of 5-day mean readings of measurements of flow of the Nile River for six years, together with the results of experiments on the methods of procedure. Studies of the effect of turbulent flow on current meters led to the conclusion that it is unlikely that serious reductions will have to be made to correct current meter discharges for the effects of turbulence even in flood time, thus making current meters when properly used as reliable in the flood as they are at the lower stages of the river.

Egyptian water supplies, C. TODD ET AL. (*Egypt Dept. Pub. Health, Rpts. and Notes Pub. Health Labs., No. 3* (*1920*), *pp.* [*II*]+*105, pls. 4*).—This report contains a large amount of data on the chemical composition of Nile water, methods for its purification, and Egyptian water supplies in general.

Public Roads (*U. S. Dept. Agr., Public Roads, 3* (*1920*), *No. 27, pp. 28, figs. 23*).—This number of this periodical contains the following articles: Highway Administration and Road Conditions in France; Suggestions for Improvement of the Deval Abrasion Test for Rock, by F. H. Jackson (see p. 85); The Char-

acteristics of Steam Distilled Petroleum Residuals, by B. A. Anderton (see below); Good Progress in Impact Tests; Photographic Hints for Engineers, by J. K. Hillers, jr.; Last Apportionment of Federal Aid; The Manufacture and Use of Laboratory Diamond Core Drills, by F. H. Schloer; and Federal-aid Allowances During June, 1920.

Suggestions for improvement of the Deval abrasion test for rock, F. H. Jackson (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 27, pp. 9-12, figs. 4*).—Results of the standard Deval abrasion test of road-building rock are reported, showing that when conducted in the usual way the results are accurate to within 1 per cent. The difficulty of properly preparing samples by hand in a reasonable length of time is considered to be the principal reason for the discrepancies in results observed.

A machine is briefly described by means of which samples may be prepared conveniently and accurately. Tests showed that the range in values of percentage of wear is greatly increased by the use of a slotted cylinder which permits the dust of abrasion to escape as fast as it is formed. In general, the difference between percentage of wear as determined in the standard and in the slotted cylinder increased as the coefficient of hardness of the rock decreased.

The characteristics of steam distilled petroleum residuals, B. A. Anderton (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 27, pp. 13-17, figs. 11*).—Data are summarized and correlated to indicate the significance of some of the present tests of bituminous road materials. Data obtained from the operation of a small experimental refinery involving steam distillation are included. Three typical crude petroleums from California, southern Texas, and Mexican fields were used and tests made of the residuals.

It is concluded that the two points of greatest interest resulting from these tests are (1) the significance of the fixed carbon test in relation to the progress of steam distillation, and (2) the development of the float test as a measure of viscosity and susceptibility to temperature changes.

Costs on four types of pavement in Philadelphia test road (*Engin. News-Rec., 85 (1920), No. 13, pp. 607, 608*).—A comparison of 26 sections of test road, comprising mixed and penetration bituminous macadam and concrete and vitrified block, showed that the penetration macadam road was the least expensive.

Experimental road construction in West Perthshire, W. L. Gibson (*Surveyor and Munic. and County Engin., 57 (1920), No. 1484, pp. 533, 534*).—Results of a 5-year test of nine different experimental lengths of road are reported. These included different types of water-bound, surface tarred, and mixed bituminous macadam.

The section showing the best results was a tar macadam surface sealed with distilled tar. At the end of the experimental period the surface was found to be waterproof, dustless, nonslippery, durable, and not affected by atmospheric changes. The next best results were obtained with macadam grouted with pitch and oil and macadam grouted with a mixture of Mexican asphalts. The poorest results were obtained with ordinary water-bound macadam.

The tests also showed that in the construction of tar-treated roads the necessity of having a very strong stone is not of predominant importance.

The design of highway bridges of steel, timber, and concrete, M. S. Ketchum (*New York: McGraw-Hill Book Co., Inc., 1920, 2. ed., rev., pp. XV+548, pls. 7, fig. 379*).—This is the second revised edition of this book which was prepared on the basis of the increase in live loads due to the extensive use of heavy motor trucks, tractors and traction engines, and the increased use of reinforced concrete in highway bridges. Part 1 covers the calculation of stresses in bridge trusses, portals, and other details. Part 2 covers the design of steel and timber highway bridges. Part 3 deals with the design of rein-

forced concrete highway bridges and foundations. Part 4 covers the details of bridge design, contracting, erection, and construction, together with estimates and costs. Three appendixes contain specifications for steel and concrete bridges and design data.

Motor operation costs as affected by highway location and grade design, I–III, W. G. HARGER (*Engin. News-Rec., 85 (1920), Nos. 3, pp. 104–107; 4, pp. 171–173; 5, pp. 200–202, figs. 7*).—This article outlines the desirable features of highway location from the standpoint of motor operation, and indicates the practical limitations in their application. It is pointed out that needlessly short mileage is the most serious criticism that can be made of any general policy.

The design of a highway should comply as nearly as possible with the theoretical demands of cheap operation. The basic principles used in this connection are stated as follows: The selection and consistency of maximum grade within the bounds of standard practice is not affected by the ability of single-unit motor vehicles to climb and does not affect the factor of safe descent. Long trailer trains would modify the maximum grade. For fixed rise and fall and distance, a combination of different rates of grade has no effect on fuel consumption, but probably slightly increases the total cost of motor operation over that for a uniform grade. For a fixed rise and variable distance, depending upon the rate of grade, the lower the rate of grade the higher is the operating cost. Under these conditions the grade should be the steepest within reason.

The grade at which gears are shifted for the ordinary car on improved roads is about 6 per cent, for pleasure cars 10 per cent, and for standard trucks 5 to 8 per cent. The value of distance saved can be closely approximated. The value of rise and fall saved can not be closely figured, but it has more money value on steep than on light grades.

In locating roads, distance can be balanced against rise but it is not possible to analyze this closely. As a rule, distance should rarely be increased, particularly if good alignment is lost, unless it is necessary to get a reasonable maximum grade or a noticeable rise and fall can be eliminated by a short additional distance.

Technique of tractor plowing in plats, T. BALLU (*Jour. Agr. Prat., n. ser., 32 (1919), Nos. 26, pp. 530–533; 27, pp. 553–555; 28, pp. 573–575; 29, pp. 593–595, figs. 24*).—Procedure in laying off land for tractor plowing and in the operation of plowing is described.

Mechanical cultivation, CORDIER (*Dir. Gén. Agr., Com., et Colon. [Tunis], Bul., 23 (1919), No. 97, pp. 207–220*).—The results of tests of 58 tractor plowing outfits at Senlis during the week of September 29, 1919, are reported.

The machines tested included Italian, American, and French makes. The land plowed was slightly sloping, and the soil was sandy with a compact subsoil close to the surface. It had not been broken for four years.

The results indicated a tendency toward average weight and average power tractors, weights varying from 1,000 to 3,000 kg. and powers from 10 to 30 h. p. It is noted that the more flexible machines developed the greatest average power. Cable traction was found to demand an excess of equipment, while a mixture of cable and direct traction appeared to combine the advantages of the two systems and did not indicate any of their inconveniences. Direct traction, however, gave the best general results with tractors of average power.

Tile-trenching machinery, D. L. YARNELL (*U. S. Dept. Agr., Farmers' Bul. 1131 (1920), pp. 27, figs. 19*).—Four general classes of tile trenching machines are described and illustrated as follows: (1) Plows and scoops, (2) wheel excava-

tors, (3) endless-chain excavators, and (4) scraper excavators. These, broadly speaking, include horse-drawn ditching plows, varying in cost from $20 to $500, which will excavate trenches suitable for the smaller sizes of tile, and power operated machines, costing from $2,500 to $3,500, adapted to the use of contractors.

Devices for backfilling trenches, ranging from the ordinary moldboard plow to power-driven backfillers, are also described and illustrated.

Data on capacities and costs of operation are given. It is pointed out that the cost of trenching by machinery does not differ greatly from that of handwork, but that the advantages of the former are the fewer men required and the more rapid completion of the work.

Treating fence posts on farm, W. R. MATTOON (*La. Agr. Col. Ext. Circ. 37 (1920), pp. 20, figs. 11*).—Experiments conducted under a cooperative agreement between the Forest Service of the U. S. Department of Agriculture and the Louisiana Experiment Stations are reported.

Fence posts of six different kinds of native woods were treated with creosote and set in the year 1908 and carefully examined in 1918. The woods treated were black gum, tupelo gum, sweet gum, sap pine, bay, and cypress. Out of every hundred posts treated and set, 97 black gum remained sound, 2 were found with some defect, and 1 had to be removed on account of wood decay. Round cypress showed almost as good results, 2 in every hundred having to be removed because of decay. Tupelo gum and sweet gum ranked next, with 89 and 87 posts sound, 6 and 11 defective, and 5 and 2 removed on account of defect, respectively. Sap pine showed 73 to be sound, 15 slightly defective, 9 badly defective, and 3 removed on account of decay. Bay made the poorest showing, with 68 sound, 15 defective, and 17 removed.

The open-tank method of applying hot and cold baths was used. All posts were treated with coal-tar creosote. The length of time the posts remained in the hot and cold baths of creosote varied from one to three hours each. The amount of creosote used for all posts averaged between 5 and 6 lbs. per cubic foot of wood. For posts averaging 3½ in. in top diameter, about ½ gal. of creosote if carefully handled was found to afford ample absorption and penetration.

Reference is briefly made to a practical method of creosoting fence posts for the use of farmers. Specifications for creosote oil for open-tank treatment of timber are included.

Poultry houses, A. R. LEE (*U. S. Dept. Agr., Farmers' Bul. 1113 (1920), pp. 8, figs. 4*).—Brief and very popular information on the location and planning of poultry houses is given.

Planning the farmstead, M. C. BETTS and W. R. HUMPHRIES (*U. S. Dept. Agr., Farmers' Bul. 1132 (1920), pp. 24, figs. 8*).—The general principles involved in planning the arrangement of the buildings of the farmstead with reference to one another are set forth and illustrated by application to a farmstead of a type common to the Middle West.

The main considerations influencing the determination of the farmstead site are its location with respect to the rest of the farm and to public utilities, the elevation and drainage of the proposed site, the available water supply, the nature of the soil, the relation to the points of the compass, the prevailing breezes, and protection from heat and cold. After the site has been selected, the type of farming practiced, together with efficient routing of routine work, have an important bearing on the arrangement of the various buildings.

Sanitation applied to the rural home, E. L. BISHOP (*Tenn. Agr. Col. Ext. Pub. 81 (1920), pp. 11, figs. 6*).—General practical information on protection of rural water supplies and disposal of waste is given.

Rural plumbing, water supply, and sewage disposal systems, F. R. King (*Dom. Engin., 92 (1920), Nos. 12, pp. 585-587, 625, 626; 13, pp. 636, 637, 673, 674, figs. 12*).—Practical suggestions for making the country home modern and sanitary are given.

Stability of and heat transmission through thin walls (*Surveyor and Munic. and County Engin., 58 (1920), No. 1492, pp. 123, 124*).—This is a report of the building materials research committee of the Department of Scientific and Industrial Research of England, in which the results of investigations on the stability of thin walls and heat transmission through thin walls are presented.

It is concluded that walls as thin as 2⅝ in. can be used safely for partitions in cottage building in England, even when supporting joists. In the heat transmission studies, a 4½-in. rough concrete wall offered the least resistance, while a 10-in. concrete cavity unventilated wall, with the inner partition of coke breeze, offered the greatest resistance to the flow of heat, indicating the efficiency of the breeze as an insulator.

The insulating effect of the wall was found to be comparatively little reduced by providing a limited amount of ventilation in the cavity, particularly if this is arranged at the base of the cavity only.

A homemade milk refrigerator (*Pub. Health Serv. U. S., Pub. Health Bul. 102 (1919), pp. 4, figs. 2*).—A simple refrigerator made of a wooden box, a covered earthenware crock, oil cloth, and newspapers for keeping bottled milk cool is described and illustrated.

RURAL ECONOMICS AND SOCIOLOGY.

Thirteenth and fourteenth annual report of the State demonstration farms, 1918 and 1919, W. R. Porter (*North Dakota Sta. Bul. 135 (1920), pp. 83, fig. 1*).—This report presents detailed data covering costs and methods of production of field crops on demonstration farms in North Dakota in various rotations and under a wide range of conditions. The results obtained with various crops during 10 years of crop rotation on the farms at Hazelton, Hoople, Jamestown, Portland, Rugby, Wahpeton, Washburn, Dawson, Mohall, and Oakes are included in tabulated summaries. Results on the demonstration farms in work with small grains, corn, forage, rotations, weed control, and fertilizer, horticultural, and soil problems are stated in conclusion.

Cost and yield data of some of the more important crops on the farms in 1918 and 1919 are given in the following table:

Cost of production of field crops on demonstration farms in North Dakota in 1918 and 1919.

Crop.	Acreage.		Average yields per acre		Cost per acre.		Income per acre.		Profit per acre.	
	1918	1919	1918	1919	1918	1919	1918	1919	1918	1919
			Bu.	*Bu.*						
Durum wheat	52	76	15.38	9.25	$13.93	$12.44	$31 83	$16.44	$17.90	$4.00
Hard wheat	132	124	17.62	18.58	13.91	14.08	35.73	33.08	21.82	19.00
Oats	32	36	37.39	31.39	15.80	13.95	24.20	17.45	8.40	3.50
Barley	48	32	20.77	14.79	14.23	12.12	14.76	14.22	0.53	2.10
Corn	104	92	20.02	30.83	14.65	15.45	21.16	38.78	6.51	23.33
			Lbs.	*Lbs.*						
Alfalfa	28	40	3,407	3,270	11.65	11.62	35.81	37.24	24.16	25.62

Milk prices and cost of milk production, F. A. PEARSON (*Jour. Dairy Sci., 3 (1920), No. 3, pp. 180–189, fig. 1*).—This material has been noted from Illinois Station Bulletin 224 (E. S. R., 42, p. 563).

The price of milk, C. L. KING (*Philadelphia: John C. Winston Co., 1920, pp. 336, pls. 2, figs. 20*).—This volume is based upon the author's experience with the Governors' Tri-State Milk Commission and the U. S. Food Administration (E. S. R., 40, p. 280). It is divided into three parts dealing, respectively, with the price of milk to the producer, the cost of distributing milk, and fair price policies. The first part includes discussions of the relation of manufactured milk products on the price of fluid milk, the use of formulas to determine the cost of production, and the policies of dairymen's organizations in relation to price. The second part includes data on the cost of distribution, relation of sanitary requirements to price, and the possibility of making milk distribution a municipal function. Successful methods of reducing the cost of distribution in eastern cities of the United States are outlined in greater detail than in a previously noted paper of the author (E. S. R., 43, p. 877).

A method of analyzing the farm business, H. M. DIXON and H. W. HAWTHORNE (*U. S. Dept. Agr., Farmers' Bul. 1139 (1920), pp. 40, fig. 1*).—This bulletin enlarges upon the method outlined in an earlier one (E. S. R., 33, p. 91), adding tables and graphic representations of the percentage of the average labor income attributed to each of four factors affecting farm profits, size of business, crop yields, returns from live stock, and efficiency in the use of labor, including a study of 4,244 farms in 12 areas; also of a comparison of farm profits when one, two, three, and all four of the factors are above the average of the area.

Factors that make for success in farming in the South, C. L. GOODRICH (*U. S. Dept. Agr., Farmers' Bul. 1121 (1920), pp. 31, figs. 44*).—Charts and text explain the variation in farm incomes found in a community of farms in Georgia on the basis of such farm practices as the growing of legumes, prompt harvesting, and selection and care of seeds. The influence of systems of farming on wheat yields in Minnesota (E. S. R., 9, p. 641) and on corn yields in Illinois (E. S. R., 20, p. 131), of quality in dairy cows on farm income on two Pennsylvania dairy farms, of efficiency in the use of mule and man labor and machinery on cotton and corn farms in sections of Georgia, Texas, and Alabama, and of size of business and adjustment of farm enterprises are similarly illustrated.

Ashland community survey: An economic, social, and sanitary survey in Howard County, Mo., C. C. TAYLOR and E. W. LEHMANN (*Missouri Sta. Bul. 173 (1920), pp. 16, figs. 9*).—A rural community especially stable, prosperous, and well-equipped socially and educationally but deficient in home sanitation and equipment is revealed from this study.

Farm labor in Wisconsin, H. C. TAYLOR and J. D. BLACK (*Wisconsin Sta. Bul. 316 (1920), pp. 48, figs. 9*).—It is indicated that from 1880 to 1910 the supply of farm labor increased faster than the land in farms, improved land, number of farms, and number of farmers, but that the demand increased faster than the supply, principally because of the increase in dairy and live-stock farming. In Wisconsin, 70 per cent of the farm labor is made up of farmers' sons, more often than not sons of foreign-born parents.

This bulletin offers some tabulated returns from surveys in 1918 and preceding years, touching several phases of the questions of farm wages and hours in Wisconsin. It gives also suggestions as to hiring and handling farm labor.

Prices of farm produce and wages of farm workers, A. W. ASHBY (*Jour. Roy. Agr. Soc. England, 80 (1919), pp. 46–75, figs. 13*).—It is indicated that the influence of prices of cereals on the economic condition of the farm laborer

has not been so great, especially during the nineteenth and twentieth centuries, as has been commonly supposed.

Index numbers of prices and wages in Great Britain through a period of years, mainly from 1880 to 1915, are platted in 13 charts which illustrate not only the small influence of prices on wages but equally the small influence of wages on prices. The results show that wages do not rise and fall in proportion to changes in retail prices, but that the worker obtains some increase in real wages as a result of falling retail prices and suffers from disadvantage when retail prices rise. It is said that cereal prices do not provide an index to the general level of prices of farm products. During the nineteenth century, especially during the last quarter, the influence of the prices of breadstuffs on the farm worker's prosperity has declined as his standard of living has risen.

The work of the agricultural wages board in 1919, A. W. ASHBY (*Jour. Roy. Agr. Soc. England, 80* (*1919*), *pp. 164–176*).—This review refers to the last 10 months of the year 1919, including tables for hours and rates of wages established. Appendixes give the text of orders and schedules in regard to minimum rates of wages and employment in agriculture in England.

The land tax, J. ARNOTT (*Jour. Roy. Agr. Soc. England, 80* (*1919*), *pp. 133–145*).—These pages present a brief history and discussion of the technicalities and inconveniences of this tax in England and Scotland.

Contemporary agricultural law, A. J. SPENCER (*Jour. Roy. Agr. Soc. England, 80* (*1919*), *pp. 149–164*).—Recent legislation and decisions of the courts bearing directly or indirectly on British agricultural interests are summarized.

The food of the people (*London: Natl. Farmers' Union, 1920, pp. 35*).—A statement is made of a national agricultural policy recommended by the National Farmers' Union for the effective reconstruction of British agriculture and the increase of home grown food supplies.

Crop cycles in the United Kingdom and in France, H. L. MOORE (*Jour. Roy. Statis. Soc., 83* (*1920*), *No. 3, pp. 445–454, figs. 6*).—This carries a step further the inquiry of an earlier paper (E. S. R., 41, p. 892) by means of similar methods. The conclusions are reached that there are well-defined approximately synchronous 8-year cycles in the yield per acre of the crops in the United Kingdom, France, and the United States, that in the United Kingdom and France the 8-year cycle is a compound cycle of 8 and 4 years with principal and minor maxima approximately 4 years apart, and that the periodicities suggest a possible 6-year cycle producing an interference that may in part account for the observed variations in crop cycles.

Interesting inside facts related to the Department of Agriculture, E. T. MEREDITH (*Banker and Manfr., 14* (*1920*), *No. 8, pp. 17, 38, 39*).—In this address is given a brief account of the work of the Department in aiding live stock and crop production in the United States.

Agricultural cooperation in Denmark, J. G. GUGGEMOS (*Landw. Jahrb. Bayern, 8* (*1918*), *No. 9–10, pp. 547–676*).—This gives an historical review of Danish cooperation organizations for the production and marketing of live stock and live-stock products, sugar, potato flour, and similar agricultural commodities, for purchase and sale, credit, and insurance. Statistics taken from official reports indicate the increase in the proportion of the agricultural population involved and in the financial importance of the movement.

A plan for cooperation between farmer and consumer, B. MACKAYE (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev., 11* (*1920*), *No. 2, pp. 1–21, figs. 10*).—The plan for a postal marketing project herein outlined is a development of a part of the author's land utilization program, and was embodied in a report submitted to the Fourth Assistant Postmaster General, of which these pages are a summary. The way in which the system might be applied to

the city of Washington, D. C., as a distributing center of a rural supply unit lying along the Potomac River between Alexandria, Va., and the Loudoun County line is outlined and illustrated, and the extension of the system throughout the country is suggested.

Cooperative marketing, O. B. JESNESS (*U. S. Dept. Agr., Farmers' Bul. 1144 (1920), pp. 27*).—In view of the rapidly growing recognition of the importance of the 14,000 farmers' cooperative organizations in the improvement of marketing methods, this publication offers suggestions in matters of formation of organizations, financing, management, duties of members, etc.

Cooperative marketing, O. B. JESNESS (*Reclam. Rec. [U. S.], 11 (1920), No. 9, pp. 408-410, figs. 4*).—A number of successful growers' exchanges are briefly noted. Suggestions are made of steps to be followed in community organization for cooperative marketing.

Systematizing distribution methods, C. W. THOMPSON (*N. J. Dept. Agr. Bul. 23 (1920), pp. 234-252*).—In this address the advantages of standardization, organization for the marketing of farm products, and adequate news service are urged.

Wisconsin live stock shipping associations, B. H. HIBBARD, L. G. FOSTER, and D. G. DAVIS (*Wisconsin Sta. Bul. 314 (1920), pp. 22, figs. 4*).—This is an account of the development of cooperative live stock shipping associations in Wisconsin, with notes on their methods of operation and a model constitution and by-laws.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 2 (1920), Nos. 11, pp. 161-176, fig. 1; 12, pp. 177-192; 13, pp. 193-208; 14, pp. 209-224, figs. 3*).—These numbers contain the usual weekly and monthly summaries, and brief articles on domestic movement, imports and exports, prices of specified commodities, and marketing conditions for important classes of agricultural products, together with notes on foreign market situations.

Special articles on the produce required to supply New York City, the estimated heavier production of medium red and alsike clover and alfalfa seed crops over those of 1919, and the price depressing effect of heavy importations into the United States of Asiatic peanuts and peanut oil appear in No. 11. In No. 12 it is noted that a market for boxed apples from the United States is offered in Scandinavian countries, an increase in white clover seed production is reported, and the repeal of various State weight per bushel laws relating to fruits and vegetables with the adoption of the Winchester bushel of 2,150.42 cu. in. as a standard for fruits and vegetables sold by volume is urged. In No. 13 there are brief articles on the difficulties of harvesting boxed apples in the United States hinging upon restricted credits, lower prices, and reports of large crops; decreased stocker and feeder shipments; and cold storage holdings of meats. The world wool situation according to data from various official sources, the demoralization of the condensed milk market, and potato prices in the last 10 years as depedent upon size of crop and other factors are reviewed in No. 14.

[Agricultural statistics of Canada] (*Canada Yearbook, 1919, pp. 168-225*).—In this section of this report are included statistics of agriculture for 1919 as previously noted (E. S. R., 41, p. 295).

[Agriculture in Roumania, 1919 and 1920], M. FILOTTI, G. THEODORU, and E. GUIBGEA (*Bul. Statis. Roumaniei, 4. ser., 14 (1919), No. 2, pp. 220-221, 246-256, 308-347; 15 (1920), No. 3, pp. 40-69, 119-169*).—These pages include reports on agricultural population, the area sown and crops produced, the details of landholding, and statistics as to the number of the rural population.

Agriculture [in Algeria], J. B. ABEL (*Exposé Situation Gén. Algérie, 1919, pp. 776-870*).—Notes on the production of and trade in the principal agricul-

tural crops and live stock are given, continuing previous data (E. S. R., 41, p. 493).

Report on census of agricultural and pastoral production, 1918, C. W. Cousins (*Union So. Africa, Off. Census and Statis., Agr. Census, 1918, pp. 73*).—The tables presented here embody the results of a census for the fiscal year 1918, the first of its kind taken under terms of recent legislation.

Annual report on reforms and progress in Chosen (Korea), 1917–18 (*Ann. Rpt. Reforms and Prog. Chosen (Korea), 1917–18, pp. XIII+171, pls. 8*).—This continues information previously noted (E. S. R., 41, p. 94).

AGRICULTURAL EDUCATION.

The scientific organization of agriculture in the colonies, G. Wery (*Ann. Inst. Natl. Agron., 2. ser., 13 (1918), No. 2, pp. 275–362; 14 (1919), pp. 33–74*).—This report, which was presented at the Colonial Congress of Agriculture, consists of three parts.

Part 1 endeavors to show how the application of scientific methods aids in the development of colonial agriculture, the necessity of botanic and experimental gardens, experimental farms, laboratories, and research stations, and the importance of the agricultural school, itinerant instructor, demonstration fields, the agricultural book and journal, agricultural associations, etc., in the dissemination of agricultural information. It is pointed out that the organization of agricultural education in the colonies must vary with the intellectual development of the population, but that instruction in agriculture should be given, consisting of nature study and school gardening in the elementary school and of elementary technical instruction either in the farm school or at the colonial experimental farm, where young natives may receive essentially practical instruction in the use of agricultural implements, etc. Schools functioning at the experimental gardens and research stations should give a little higher instruction for the training of instructors, overseers, foremen, head gardeners, etc. The instruction given in the agricultural colleges will depend on the state of advancement of agricultural research in the colony. A higher course in colonial agriculture, which comprises only the fundamental laws of science applicable in all latitudes without doubt would have its value from a general point of view, but would be of little value in the agriculture of a particular colony. Before establishing higher instruction in a definite or certain colony it would be necessary to forge the material of subject matter, and this is the affair of the research stations which should precede the colleges of agriculture.

Part 2 contains an account of the present scientific work in agriculture in the colonies of France, Great Britain, the Netherlands, the United States of America, Belgium, and the former German colonies. It is stated that while much has been realized, the French colonial domain, as a whole, is still in need of experimental and botanic gardens, demonstration fields, experimental farms, and experiment stations.

In part 3 are given accounts of the agencies for the promotion of agriculture in the colonies of France, Great Britain, the Netherlands, and Italy.

High school departments of vocational agriculture, A. K. Getman (*Univ. State N. Y. Bul. 703 (1920), pp. 32, pls. 3*).—This bulletin treats of the organization and administration of high school departments of vocational agriculture in the State of New York.

Two types of curriculums for high school agricultural departments are recognized, viz, a 4-year curriculum leading to an academic diploma in vocational agriculture and a curriculum of less than 4 years for sections of the

State where the agriculture is too specialized or the enrollment too small. Suggestions are offered with reference to provision for three groups of pupils, viz, (1) pupils pursuing the agricultural curriculum leading to the diploma, (2) boys and young men who have left school without completing the elementary or high school courses and who may be interested in receiving definite instruction in the vocation of farming, and (3) adults living and working on farms, desiring instruction in specialized phases of their work.

It is considered neither necessary nor desirable for a school to own a farm. Boards of education and teachers of agriculture are urged, however, to conduct a school plat, ranging from one-half of an acre to not more than two acres, to furnish a means of objective teaching, of vitalizing much of the agricultural instruction by providing a point of contact between the subject matter study and the practice at the homes of the pupils and on neighboring farms, and of conserving the time and effort of the teacher of agriculture by group instruction. Phases of summer work suggested for the teacher of agriculture include the supervision of senior and junior projects, collecting materials for classroom and laboratory use, locating objective points and making arrangements for field trips for the following year, studying the agricultural practices of the region by means of surveys and special conferences, investigating the need and making preliminary arrangements for short unit and evening courses, cooperating with organized agencies in conducting community work, and attending to the school plat.

Forest academy or agricultural high school, L. TSCHERMAK (*Österr. Forst u. Jagd Ztg.*, *38* (*1920*), *No. 7*, *pp. 41*, *42*).—The author discusses the advantages of the agricultural high school over the forest academy for giving higher instruction in forestry. In his opinion the forest academies of Austria are generally too isolated and small to provide the necessary facilities of staff, equipment, and subject matter, including the natural and political sciences necessary for a well-rounded course of instruction for training professional foresters and investigators.

A law for rural continuation instruction in Czechoslovakia, R. HÜBNER (*Wiener Landw. Ztg.*, *70* (*1920*), *No. 25*, *pp. 185*, *186*).—This is a statement of the provisions of a law passed on January 29, 1920, by the General Assembly of Czechoslovakia for the organization and regulation of agricultural continuation schools. Free instruction is offered, extending over two or three years, depending on local conditions. The winter months are devoted to instruction in theory and the summer months to practical work. The Ministry of Agriculture decides upon the establishment and discontinuance of these schools, has charge of their higher administration and of the provision of funds for their development, and at the request of the local school board, appoints the director and instructors. A course of study has been issued by the ministry.

Extension education in the United States, M. E. HOBBS (*Scot. Jour. Agr.*, *3* (*1920*), *No. 2*, *pp. 220–225*).—This is a description of the organization and administration of the agricultural extension education in the United States. In summarizing, the author places special emphasis on the following points in the educational and economic aspects of this system:

"It is a unified system, and provides adequate means for bringing the results of scientific research to the people who are going to put them into practice, and at the same time, by correlating all agencies at work, it makes the results of this practice available for the determination of lines of future research and for the guidance of Government policy in the agricultural industry and in rural development." It is part of a general education system and is essentially a cooperative effort with the community as a basis, but at the

same time affording ample scope for the development of individual leadership and initiative. Its elasticity of form admits of its application to widely differing conditions and yet provides a common basis for the federation of rural interests. "It provides a system into which the pupils, the farmer, and his family are integrated in a community organization, themselves providing the demonstrations of the results of scientific practice, and thereby securing that continuity of effort and permanency of result which experience has always shown can not be attained by a specialist working alone."

By increasing production it has brought increased wealth to the Nation. "It enables the Nation in any great emergency to reach with a minimum of time and expenditure the entire body of producers. . . . It is a stabilizing force in the Nation, making for greater permanency in rural life and tending to preserve a more even balance between the town and the country population."

County agent work in the Northern and Western States, 1919, W. A. Lloyd (*U. S. Dept. Agr., Dept. Circ. 106 (1920), pp. 19, figs. 10*).—This is a report on the status and results of county agent work in farm crops, live stock, soil fertility, and farm homes and farm business in the Northern and Western States in 1919. It deals with the problem of personnel; coordination of extension effort; community, State, and national programs; farm management and farm economics; demonstrations; records and reports; some extension agencies; and an average week's work for a county agent. The author concludes that "county agent work has passed safely through its period of greatest expansion and successfully withstood the danger of serious reaction. It has made good with the farmer, and the agent's position of leadership in rural affairs is no longer questioned. The problem is not now so much one of further expansion as of training competent men to fill the positions, and keeping good men contented in the work."

Making things.—I, The four year rotation plan for vitalizing agriculture in the rural schools, P. G. Holden and C. M. Carroll (*Chicago: Internatl. Harvester Co., 1919, pp. 72, figs. 55*).—Lessons are outlined giving instructions for making practical articles from wood, and for rope work—the tying of knots and hitches and the making of splices.

Forestry lessons on home woodlands, W. R. Mattoon and A. Dille (*U. S. Dept. Agr. Bul. 863 (1920), pp. 46, pl. 1, figs. 20*).—The lessons outlined in this bulletin deal with forest trees and forest types; the location and extent of woodlands; the economic value of the forest; products from the home forest; using, measuring, estimating, and marketing farm timber; protecting the woods; improving the home forest by cutting; the growth of trees and forests; forest reproduction; and woodlands and farm management. They have been prepared to give to the organized school work in agriculture an additional impetus in forestry, to provide material for instruction that is within the range of elementary pupils, and to furnish a topic for home projects. Each lesson states the problem and suggests sources of information, illustrative material, topics of study, practical exercises, field study, and correlations. Lists of publications of the Department relating to forestry on farm woodlands, addresses of State forestry departments, the Doyle rule for scaling logs, and a key to common kinds of trees and a list of 100 important forest trees of the eastern half of the United States, with descriptions by W. H. Lamb, are included.

MISCELLANEOUS.

Report of Hawaii Station, 1919 (*Hawaii Sta. Rpt. 1919, pp. 73, pls. 10*).—This contains the organization list, a summary by the agronomist in charge as to the work of the year, and reports of the divisions of horticulture, chem-

istry, agronomy, plant pathology, poultry, and extension, and of the Glenwood Substation. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-seventh Annual Report of New York State Station, 1918 (*New York State Sta. Rpt. 1918, pp. VII+484, pls. 37, figs. 51*).—This contains the organization list; a financial statement for the fiscal year ended June 30, 1918; a list of periodicals received by the station; meteorological observations abstracted on page 17 of this issue; reprints of Bulletins 446–451, 453, 456, and 457; Technical Bulletins 64 and 65; and popular editions of Bulletins 447, 450, and 451, all of which have been previously noted; and of Circulars 54, rev., Milking Machines (pp. 126–130); 56, The Standardization of Market Milk, by L. L. Van Slyke (pp. 131–139); 57, Insect Injuries of Apple Fruit, by B. B. Fulton (pp. 377–391); and 58, Counting Bacteria by Means of the Microscope, by R. S. Breed and J. D. Brew (pp. 140–151).

Twelfth Annual Report of the Dickinson Substation, 1919 (*North Dakota Sta. Bul. 138 (1920), pp. 24, figs. 6*).—This bulletin consists of the twelfth annual report of this substation. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-first and Thirty-second Annual Reports of Rhode Island Station, 1918 and 1919 (*Rhode Island Sta. Rpt. 1918, pp. 8; 1919, pp. 18*).—These reports by the director include experimental work for the most part abstracted elsewhere in this issue or previously noted.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 6, pp. 81–96, figs. 2*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Feeding Factor and Poultry Disease, by W. T. Johnson; and Suggestions for Holding a Dairy Cattle Sale, by E. G. Woodward.

NOTES.

Idaho University and Station.—Dr. Alfred Horatio Upham of Miami University has been appointed president, beginning December 1, 1920. Other appointments include Dr. B. L. Taylor as instructor in veterinary science vice C. O. Williamson, resigned to engage in commercial work; Ambrose W. Johnson, a 1920 graduate of the university, as assistant animal husbandman in the station; H. P. Magnuson of the Bureau of Soils, U. S. Department of Agriculture, as soils chemist; and T. C. Mead as associate professor of agricultural engineering in the university and associate engineer in the station.

A branch seed laboratory has been established at the university, particularly for the use of seed growers, dealers, and farmers in northern Idaho. Considerable new equipment has been installed and additional greenhouse space allotted for germination tests.

Kentucky Station.—Miss Mary E. Sweeny, head of the department of home economics, has resigned to take a corresponding position at the Michigan College, beginning December 1, 1920. Maybelle Cornell has been appointed acting head of the department of home economics and Grace M. Whittemore, State leader of home demonstration extension agents. Other appointments include C. B. Williams as assistant professor of agricultural economics; W. C. Pierce as assistant chemist; F. J. Kielholz as assistant editor; Dr. R. E. Stephenson, assistant professor of agronomy and assistant soil chemist at the West Virginia University and Station, as field agent in agronomy extension; and Eleanor M. Enright as field agent in home economics extension.

Minnesota University and Station.—Additional facilities for college and station laboratory work in horticulture and forestry and plant physiology and pathology have been provided by remodeling the horticulture and agricultural botany buildings at a cost of $90,000.

A committee which has been considering for several months the feasibility of establishing additional schools of agriculture under the supervision of the university has recommended that no such schools be established for the present. It is advocated that further action be deferred at least until the Smith-Hughes schools shall have obtained their maximum efficiency and a thorough survey of the problem of secondary vocational education in agriculture and home making shall have shown that there is a real need for additional schools to provide facilities not better obtainable by increasing the equipment of existing schools.

Recent resignations include those of Arthur L. Anderson as assistant professor of animal husbandry to accept a corresponding position in the Iowa College; George E. Holm as assistant agricultural biochemist, effective November 1 to accept a position in the Bureau of Animal Industry, U. S. Department of Agriculture; G. F. Puttick, as instructor in plant pathology, effective November 10; F. C. Clapp as farm management demonstrator in extension work; R. C. Dahlberg as assistant professor of agricultural botany and seed analyst; Albertha Gustafson as assistant State leader of boys' and girls' club work; Anna Wentz as instructor in entomology; Frank Frolik as extension specialist in plant pathology; and William Shaw and Georgia Durkin

as assistants in soils. Recent appointments include those of Norris K. Carnes as assistant professor of animal husbandry; Charles L. Farabaugh as assistant in plant physiology; Dr. Rodney B. Harvey, plant physiologist in the Bureau of Plant Industry, U. S. Department of Agriculture, as professor of plant physiology in the university and assistant plant physiologist in the station; Guy R. B. Elliot as assistant professor of farm drainage; L. F. Garey, associate professor of agronomy in the Colorado College as assistant professor of farm management; John Husby as assistant professor of animal husbandry at Crookston; Earl A. Stewart as associate professor of agricultural physics; J. U. Leversee as instructor in farm engineering at Morris; Alfred L. Harvey as instructor in animal husbandry; Florence Defiel as instructor in entomology; Genevieve Burgan as instructor in textiles and clothing; A. G. Black as instructor in farm management; P. B. Barker as instructor in agronomy; Lottie Ward as instructor in home economics at Crookston; Amanda Ebersole as instructor in home economics; and Raymond C. Rose as extension specialist in plant pathology.

Nebraska University.—Dr. Ernest Anderson, formerly associate professor of chemistry in the Massachusetts College and for the past three years professor of agricultural chemistry in Transvaal University College, Pretoria, has been appointed professor of general chemistry. Clarence E. Mickel, extension entomologist, has resigned to accept a commercial position.

New Mexico College and Station.—The new board of regents includes George Curry, president, of Socorro; W. A. Sutherland, secretary-treasurer, of Las Cruces; and F. M. Bojorquez, of Hillsboro; M. Mandell, of Albuquerque; and A. J. Fountain, of Mesilla.

J. G. Griffith, head of the department of biology and station entomologist, resigned August 20, 1920, to accept a position in the high school of Pasadena, Calif., and was succeeded September 13 by Dr. Robert Middlebrook. Rupert L. Stewart resigned October 20 as professor of agronomy and station agronomist to accept a position in the high school of Pomona, Calif., and was succeeded by C. A. Thompson, assistant professor of agronomy, for one month when he in turn accepted a position at the Washington College. S. W. Wentworth, assistant horticulturist, resigned September 20 to accept a similar position at the New Hampshire College and Leon H. Leonian, assistant biologist, September 25, to take up advanced work at the University of Michigan. The latter position was filled by the appointment of W. Andrew Archer, a 1920 graduate of the college. Other resignations include R. B. Thompson as head of the poultry department and station poultryman to accept a similar position at the University of Arizona; V. F. Payne, nutrition chemist, to become professor of chemistry in Palmer College, Albany, Mo.; and Stanley Brown as assistant chemist. F. E. Uhl has been appointed head of the poultry department and station poultryman.

North Carolina College.—Gordon K. Middleton, instructor in farm crops, has been appointed by the Southern Baptist Missionary Board to take charge of live-stock instruction in the Province of Hunan, China, where a model farm is to be established.

Oklahoma College and Station.—A. T. Whitworth of Carmen has been appointed to the State Board of Agriculture vice R. H. McLish. Glen Briggs, agronomist and horticulturist of the Guam Station, has accepted an appointment as research assistant in agronomy effective March 1, succeeding H. H. Finnell, resigned to go into Smith-Hughes work. Otis Wade, assistant professor of entomology, severed his connection with the college September 30, 1920.

Oregon College and Station.—Roy C. Jones, county agent of Tillamook County, has accepted an appointment as associate professor of dairy produc-

tion vice L. W. Wing, resigned to become manager of a pure bred Ayrshire herd at Watsonville, Calif. Frank J. Rimoldi, assistant professor of horticulture at the Rhode Island College, has been appointed instructor in pomology and assistant pomologist; and Harry A. Lindgren, live-stock editor for *Western Farm Life*, extension specialist in animal husbandry.

South Dakota College.—C. Larsen, director of extension work and dairy husbandman, has resigned to become director of a dairy products marketing department established by the Illinois Agricultural Association.

Tennessee University.—Appropriations of $25,000 have been made for new hog and sheep barns, and the construction of these buildings will be begun next spring. Recent appointments include Joseph L. Gayle as assistant in agricultural chemistry, Frances L. Morrison as instructor in rural economics, Dr. Clarence H. Kennedy as instructor in entomology, and Lewis H. Tiffany as instructor in botany.

Texas Station.—Dr. E. P. Humbert, chief of the division of plant breeding, resigned January 1 to accept a commercial position. E. B. Reynolds, superintendent of the Angleton Substation, was assigned to the staff of the main station December 1, 1920, vice H. H. Laude, whose resignation has been previously noted. V. E. Hafner, scientific assistant at the Chillicothe Substation, has been appointed superintendent at Angleton. L. P. McCall has been appointed farm superintendent of the feeding and breeding substation.

J. B. McNulty, dairy husbandman, and O. E. McConnell, assistant animal husbandman, have also resigned, the former on January 1 and the latter last fall. C. S. Rude has been appointed assistant entomologist in foul brood inspection, succeeding W. E. Jackson, resigned. A. D. Jackson has been appointed executive assistant in charge of the publicity and editorial work of the station, beginning October 1, 1920.

Vermont University and Station.—The State Board of Education has recommended the establishment by the legislature of a Teachers' College in connection with the university. In anticipation of such action, arrangements have been made to give the second year of the normal training courses at the university to students who attended the two State normal schools which were closed August 1.

Carroll M. Pike, director of the Theodore N. Vail School and Farms, has been appointed instructor in agricultural education and will assist in the supervision of agricultural teaching in the high schools of the State. Erwin W. Jenkins, formerly of the Bureau of Markets, U. S. Department of Agriculture, has been appointed assistant horticulturist.

Virginia Station.—R. C. Thomas, assistant plant pathologist, formerly employed jointly by the extension division and station, was transferred entirely to the extension division November 1, 1920.

American Society of Agronomy.—The thirteenth annual meeting of this society was held at Springfield and Amherst, Mass., October 18 and 19, 1920. The program included an afternoon session on the general subject of teaching agronomy, the usual joint evening session with the Society for the Promotion of Agricultural Science, and practically an entire day's symposium on liming.

The president's address was given by Director F. S. Harris of the Utah Station on Agronomists' Part in the World's Food Supply. Dr. Harris discussed the possibilities for increasing food production in this country by extending the productive area through irrigation, drainage, dry farming, and the reclamation of waste and cutover lands and the increasing of the yield from lands already in cultivation by augmenting the fertility of the soil, better tillage methods, and the improvement of crops by breeding. He pointed out that some development was possible in each of these ways, but that serious economic limitations precluded indefinite extension.

The other papers presented at the meeting included the following: Prerequisites for Agronomic Subjects, by L. E. Call; The First College Course in Field Crops, by W. L. Slate, jr.; The Standardization of Courses in Field Crops, by J. B. Wentz; The Teaching of Soils in Agricultural Colleges, by W. H. Stevenson and P. E. Brown; The Teaching of Soils, by A. B. Beaumont; The Teaching of Soils and its Relation to Crop Subjects, by M. F. Miller; The Need of Lime as Indicated by the Relative Toxicity of Acid Soil Conditions to Different Crops, by B. L. Hartwell; The Influence of Calcium Salts on the Growth of Seedlings, by R. H. True; Liming in its Relation to Injurious Organic Compounds in the Soil, by S. D. Conner; The Comparative Effects of Various Forms of Lime on the Nitrogen Content of the Soil, by C. A. Mooers and W. H. McIntire; The Influence of Liming on the Availability of Soil Potassium, Phosphorus, and Sulphur, by J. K. Plummer; The Nature of Soil Acidity with Regard to its Quantitative Determination, by W. H. McIntire; The Value of Limestone of Different Degrees of Fineness, by W. Frear; Comparison between Magnesian and Non-magnesian Limestones, by A. W. Blair; The Value of Liming in a Crop Rotation with and without Legumes, J. G. Lipman; Liming as Related to Farm Practice, by F. D. Gardner; and An Interpretation of the Results in Ohio Station Bulletin 336, by W. J. Spillman.

The meeting closed with an automobile trip through the Connecticut Valley to the Massachusetts Agricultural College, where the business session was held in connection with the annual dinner. Officers were elected as follows: President, C. A. Mooers; vice-presidents, S. B. Haskell and C. B. Lipman; secretary-treasurer, P. E. Brown; and member of the advisory committee on agronomy to the National Research Council, Robert Stewart.

Association of Official Agricultural Chemists.—The thirty-seventh annual convention of the association was held November 15–17, 1920, at Washington, D. C., with a registration of over 300.

The usual reports of the referees and associate referees were read and discussed, and in addition the following papers were presented: Pickering Bordeaux Sprays, by F. C. Cook; Details of Crude Fiber Method, by G. L. Bidwell and L. E. Bopst; Detection of Reground Shorts, by J. B. Reed; Detection of Reground Shorts, by D. B. Bisbee; The Distillation Method for Estimating Borax in Mixed Fertilizers, by J. M. Bartlett; Limitations of the Present Official Methods of Analysis for Insoluble Phosphoric Acid in Dicalcium Phosphate, by H. P. Nelligan; The Kjeldahl Nitrogen Method and its Modification, by A. E. Paul and E. H. Berry; The Cryoscopy of Milk, by J. Hortvet; Determination of Total Carbon Dioxid in Baking Powder, by C. S. Robinson; The Detection of Methyl Anthranilate in Fruit Juices, by F. B. Power; Effect of Use of Different Instruments in Making the Test on the Mold Content in Tomato Pulp, by B. J. Howard; A Note on the Polarization of Cider Vinegar, by E. W. Balcom and E. Yanovsky; Salad Dressings and their Analysis, by H. A. Lepper; and Cacao Products with Special Reference to Shell Content, by B. H. Silberberg.

The program of the second day included addresses by the retiring president of the association, Dr. H. C. Lythgoe, and by the honorary president, Dr. H. W. Wiley. The former spoke on The Application of the Theory of Probability to the Interpretation of Milk Analyses, while the latter discussed informally two subjects of current interest, vitamins and botulism. In the afternoon the association was addressed briefly by Hon. E. T. Meredith, Secretary of Agriculture, who emphasized the value and growing appreciation of research in agriculture.

The principal discussion in connection with the reports of the general committees at the closing session was in regard to the report of the committee on

editing method of analysis. The chairman of this committee, R. E. Doolittle, announced the publication of the first edition of the revised Official Methods (noted on p. 9 of this issue), and placed before the association the suggestion made at the previous convention that for the benefit of students in agricultural colleges reprints of the more important sections be made or that a cheaper edition of the entire book be issued to be sold only to students. After prolonged discussion the question was laid on the table for another year. It was voted that changes in methods made during the year and adopted at the annual meeting be published immediately after the meeting and distributed to subscribers. A committee of six was appointed to serve for five years to attend to this and other matters in connection with the Official Methods.

Owing to the death early in the year of the sugar referee, A. H. Bryan, no work has been done by the committee on the study of quartz plate standardization and normal weight appointed as a result of the discussion following Dr. Bryan's report at the last meeting (E. S. R., 41, p. 799). The committee was continued for another year. Resolutions were offered on the death of Dr. Bryan and of Dr. A. F. Seeker, another member of the association.

A letter from H. E. Howe, secretary of the Crop Protection Institute, recently organized through the National Research Council, was read, requesting that the association elect two of its members to serve on the board of trustees of the institute. The matter was referred to the executive board for action.

The method introduced at the last convention of grouping allied subjects under the charge of a general referee, with associate referees for special topics under the general subjects, is to be continued with the following general referees: Water, J. W. Sale; tanning materials and leather, F. P. Veitch; insecticides and fungicides, J. J. T. Graham; soils, W. H. McIntire; testing chemical reagents, G. C. Spencer; foods and feeding stuffs, J. B. Reed; saccharin products, H. S. Paine; fertilizers, R. N. Brackett; inorganic plant constituents, A. J. Patten; drugs, G. W. Hoover; nitrogen in foods, I. K. Phelps; dairy products, J. Hortvet; fats and oils, G. S. Jamieson; baking powder, L. H. Bailey; non-alcoholic beverages, W. W. Skinner; eggs and egg products, H. L. Lourie; food preservatives (saccharin), M. G. Wolfe; coloring matter, W. E. Mathewson; metals in foods, W. F. Clarke; pectin in fruits and fruit products, H. J. Wichmann; canned foods, R. W. Balcom; cereal foods, C. H. Bailey; vinegar, N. J. Geagley; flavoring extracts, C. D. Howard; meat and meat products, C. R. Moulton; spices, A. E. Paul; cacao butter, W. F. Baughman; coffee, H. A. Lepper; and tea, R. E. Andrew.

The officers for the coming year are as follows: President, W. F. Hand; vice-president, F. P. Veitch; secretary and treasurer, C. L. Alsberg; and additional members of the executive committee, A. G. Patten and H. D. Haskins. Members of the committee on recommendations of referees and revision of methods are for subcommittee A. B. B. Ross, W. H. McIntire, and C. C. McDonnell; subcommittee B, H. C. Lythgoe, E. M. Bailey, and C. A. Browne; and subcommittee C, R. E. Doolittle, W. D. Collins, and W. W. Randall. The chairmen of other committees are as follows: Editing methods of analysis, R. E. Doolittle; vegetation tests on the availability of phosphoric acid in basic slag, H. D. Haskins; testing materials on the subject of agricultural lime to cooperate with a similar committee of the American Chemical Society, W. H. McIntire; revision of methods of soil analysis, C. B. Lipman; and quartz plate standardization and normal weight, F. Bates. On the board of editors of the *Journal* W. Frear succeeded L. L. Van Slyke.

EXPERIMENT STATION RECORD.

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The interests of agricultural investigation are to a large extent bound up with those of the large organizations and movements pertaining to general science. They are not something separate and apart, and they are not different in quality with respect to the whole body of science. Indeed, the relationship is closer to-day than ever before, notwithstanding the advancement of special investigation in agriculture, partly because of the more intricate character of the present problems, and partly because of the greater bearing on them of much that is going on in general science. It is not logical, therefore, to attempt too sharp or sweeping a segregation.

Although the organization of agricultural science has departed from that defined by the basic sciences, its fundamental relationships to the latter can not be lost sight of; and although in its development there has been much specialization, the specialists need to retain in some degree their affiliations with the field of general science. Especially is this the case with respect to their organizations. Agricultural investigators must employ the methods and the materials of science as far as they are available and suited to their purpose. They may profitably take account of the trend in special branches of science and of new disclosures even though these do not apply directly to the questions before them at the time. On the other hand, they may advance the interest in investigation of agricultural questions by presenting their studies to the students of general science, and securing their suggestions and where possible their participation.

Specialists in several branches of agricultural inquiry have been led to organize societies devoted to their particular fields, in some cases because at the time there was not a place for their discussions in the general science organizations. These have been extremely useful in uniting and stimulating the interests of such inquiry, and in giving expression to the progress of investigation. They have helped to gain broader recognition for it and to attract attention to the field. But to a certain extent these agricultural organizations and their members have been disposed to hold aloof from the more general associations of science. This has been a mistake, and has cut them off from an important means of growth and influence. Their own science is not less entitled to a place there because it has

application to agricultural welfare, and such place is now more freely accorded it. Because a man is working in the field of practical problems it should not follow that his interest is limited to matters which bear directly on his problems. There is a danger in too close restriction of interest to certain practical phases or applications of scientific questions. While these agricultural specialists will wish to meet together for the consideration of topics in their special fields, their natural affiliation in general scientific matters is with the organizations representing the various departments of science as a whole, in which their specialties root. As men of science their broader contacts are thus preserved, and in addition they may gain much of value from association with persons identified with related or bordering lines. The stimulation which results is of a different type from that afforded by a more specialized group. There is a challenge in a great body of men and women laboring to advance knowledge in their respective fields which no live worker can fail to feel.

The broadening realization of these things is reflected in the increasing extent to which the meetings of the American Association for the Advancement of Science are attended by agricultural workers. This was particularly noticeable at the recent meeting at Chicago. There seemed to be an unusually large number of persons from the agricultural institutions, some of them coming from a considerable distance. This is especially noteworthy in view of the unusual expense of travel at the present time. Not a few station people have felt so keenly the disadvantage of missing these meetings that they have been willing to defray a part of their expenses, or in some cases the entire amount. But a noticeable feature of the attendance was the small number of experiment station directors. There were less than a half dozen of these present, although the location was a central one, and among these several were of the assistant or associate grade.

Such a meeting offers a remarkable opportunity for keeping in touch with what is being done in the broader ranges of science, of not only maintaining interest but learning about men and their work, following the trend of thought, seeing what matters are receiving attention. As director of a research institution broad sympathies and familiarity are important. It is not enough to be familiar with the phases with which a particular station is concerned, or even the conventional lines of agricultural inquiry, but there needs to be occasional opportunity for contact with the leaders of science, for means by which a man may continue to grow even if he is not personally engaged in research. What one may get out of such a gathering rests largely with himself.

The generosity of many directors has doubtless led to sending their staff members, and staying behind themselves to attend to the many

other things assigned them besides the management and guidance of the station work. But the question is a pertinent one whether, from his position and the responsibilities resting upon him, the director can afford not to attend such gatherings from time to time, where so much that is helpful may be gained.

Rarely if ever has there been an occasion combining so many papers which bore directly on agriculture or found their chief applications there, as the Chicago meetings. This is doubtless due in part to the fact that it was the second of the greater convocation meetings of the Association and of the national scientific societies associated with it. It was the largest meeting of its kind ever held, both in range and in attendance. In addition to fourteen sections of the Association it embraced forty-one national scientific societies, the programs of which covered the broad field of the natural and exact sciences.

The papers of agricultural interest were confined to no single section or society, but were scattered through the various programs, illustrating the present range of agricultural inquiry and the larger attention which the subject is receiving in quarters where it was not formerly accorded a place. There was, however, greater differentiation within large groups than formerly, many sections breaking up into subsections to provide programs relating to special subjects; and joint sessions and symposiums were conspicuous features. This was a logical provision in view of the large number of separate organizations meeting during the week, and it served not only to bring together somewhat widely scattered interests, but also to give a wider range to some of the proceedings. The importance to many of such a national assembly is not merely, and perhaps not primarily, the opportunity for hearing reports of progress in special fields, but the chance to get a more extended survey and to secure a composite of views.

This opportunity was afforded, for example, by the joint and separate meetings of the Federation of American Societies for Experimental Biology, which held much of interest for students in that field; and in bacteriology by the subsections for general and technical, agricultural and industrial, and public health bacteriology, pathology, and immunology. The botanists likewise broke up into subsections for morphology, anatomy and cytology, physiology, and mycology; and the sessions for genetics held by them and by the zoologists and the American Society of Naturalists were so scheduled as not to conflict. The lengthy programs of the American Phytopathological Society and the Association of Economic Entomologists were arranged topically, with informal conferences on bean diseases, potato diseases, etc.; and a symposium on dusting as a means of controlling disease and insect pests was presented at a joint session of the

two organizations. The physiological botanists held a joint session with the ecologists on topics of common interest in that field, and gave up another session to an invitation program of bio-physical papers.

At a union of all biological organizations arranged by the American Society of Naturalists, the retiring president of the latter, Dr. W. M. Wheeler, gave an address on the organization of research, emphasizing the difficulties and objections, and predicting the ultimate failure of efforts in that direction. On the other hand, the president of the American Association of Economic Entomologists, Prof. Wilmon Newell, discussed the organization of work in economic entomology in an optimistic strain, stressing the importance of cooperation particularly in carrying out large undertakings, and approving the latest addition in the cooperative field, the Crop Pest Institute.

The Society for Horticultural Science had an extensive and excellent program which well expressed the advancement being made in research in that field. An attendance of some seventy-five persons evidenced the continued success of the plan of holding meetings of this society in connection with the American Association. For the first time in its history, the American Society of Agronomy also met with the Association, its main program consisting of a symposium on present knowledge of methods of corn breeding, with papers scheduled from nine different workers in that field.

Two large gatherings worthy of special notice in this connection were a joint session of the Botanical Section, the Botanical Society of America, and the American Phytopathological Society, and another of the botanists and phytopathologists with the American Society of Agronomy. At the first of these Dr. L. H. Pammell delivered the retiring address as vice-president of the Section of Botany, on Some Phases of Economic Botany, and a symposium was presented on the relation of botany to human welfare, by C. R. Ball, H. C. Cowles and F. L. Stevens. The other joint session, in charge of the American Society of Agronomy, was composed of invitation papers by E. C. Stakman, summarizing Recent Investigations on the Black Stem Rust of Wheat and other Grains, by C. V. Piper on Plants and Plant Culture, and by H. L. Shantz on Natural Vegetation and Agriculture in Africa, illustrated with lantern slides.

Dr. Pammell's address had particular reference to the applications of botanical study to agriculture, and was an earnest plea for the larger development of such study by botanists. He declared, for example, that we have only scratched the surface so far as the real problem of cereal production is concerned, and that further advance offers attractive opportunity for botanists in studying the physiology of the nutrition of leading cereal crops, problems of

pollination under different climatic conditions, the breeding of varieties of cereals resistant to disease, etc. In his opinion, "there never was a time when research on cereals and agricultural crops was as important as it is to-day."

As to the attitude of botany in the past, Dr. Pammell declared that "we have allowed some splendid fields of work to slip away from us, largely because we were indifferent to the problems of agriculture." Referring to the taking over of some phases of plant breeding, physiology, and the soil relations of plants by workers in agriculture and horticulture, he maintained that "this work when botanical should find its place under the head of botany," and he urged "a new era in botanical work" under which these various phases of activity would find their rightful place both in teaching and in research.

There is substantial ground for a plea for greater participation by botanists in lines of research which concern cultivated plants and will thus help on the solution or better understanding of methods relating to their culture and productivity. Their services may be of great value, and a sympathetic and appreciative attitude toward agricultural investigation may help greatly in training workers for that field. But it seems doubtful whether all botany in its relations to agriculture can be assembled or held under one main department, any more than all chemistry or bacteriology can. These are methods and means of investigation as well as departments of science. Experience has quite clearly shown the importance of specialists who deal directly with the sciences as related to agricultural problems. These problems are usually broader than the field of any single natural or physical science, and they require for their solution and interpretation both an agricultural outlook and the bringing to bear of methods and data pertaining to various branches of science. While there is still abundant field for the science of botany both in the training of agronomists and horticulturists and in carrying out fundamental investigation, the nature of agricultural problems will hardly permit the organization of investigation on the strict basis of the natural sciences.

This matter of the attitude and the relations of botany toward plant culture was considered by two other speakers in a very frank and forceful way. Both of these may now be ranked as agronomists, who have come up to their present economic positions through the science of botany and have an appreciation of the botanical point of view as well as that which pertains to cultivated crops.

In the first of these papers, Carlton R. Ball showed that whereas the important early contributions to botanical science were in the field of what is now called applied or agricultural botany, and cultivated plants were for centuries felt to be worthy of the attention of the greatest botanists, a change became apparent in the nineteenth

century which marked the elimination of the discussion of crop plants from manuals of botany and the shunning of the study of such cultivated plants by the great majority of botanists. Such a discrimination was particularly untimely as it came when the biological sciences were becoming widely appreciated and far reaching developments in agricultural teaching and research were about to take place. A wall was thus erected which shut botany off from part of her own domain, a separation from which, as was pointed out, both botany and agronomy have suffered.

The relation of cultivated plants to so fundamental a phase of human welfare as the very means of subsistence gives botany an unparalleled economic connection. The most promising means of increasing the food supply, it was maintained, lie in the improvement of the present crop plants and the finding of new ones, and in this task all phases of botany, including taxonomy, morphology, physiology, ecology, genetics, and pathology, must contribute largely if substantial progress is to be made. There is no lack of opportunity, therefore, or of inspiration to be derived from the field. The need was emphasized for botanists who appreciate the fundamental importance of full taxonomic knowledge of crop plants, and of agronomists who have had good foundation training in systematic botany derived largely from the study of such plants. For these the botanical departments of the universities and the land grant colleges must be looked to. The attempt was made, furthermore, to enlist the cooperation of nonagricultural institutions, often possessing exceptional equipment and facilities, in studies directed at cultivated or crop plants, in order to aid in advancing inquiry so greatly needed.

The other paper in this connection, by C. V. Piper, was a frank and searching critique of the attitude and the claims of botany with respect to agriculture, and an argument for plant culture as being far more than applied botany. He took issue with the frequent claim that the major part of agriculture is something applied from botany, chemistry, geology, etc., and held that "ninety per cent of the garnered knowledge of botany in the traditional sense has no obvious relation to plant culture." He showed that historically the development of plant culture has been almost without contact with botany or the study of plants, as is evidenced by the discovery of food plants and their improvement by primitive men, and the development of modern methods of plant culture by farmers, gardeners, agronomists, and horticulturists. Like the other speakers, he referred to the admitted separation of botany from plant culture, a "feeling of superiority" long recognized as an important element in preventing more cordial relations between conventional botanists and plant culturists.

Combating the view that plant culture is made up largely of botany, Prof. Piper explained that the plant culturist is concerned

first of all in the methods that make for the successful culture of a plant, and secondarily in the factors or factor complexes that affect quantity or quality of yield, matters with which the botanical text-book does not concern itself. He made the rather startling statement that ninety per cent of what is known of practical methods in plant culture is almost purely empirical—made up of observed or experimental facts which are not yet explained or the reasons for them understood. But he contended that this is nevertheless real knowledge as measured by the best of standards: "it works in practice however little we may know about the underlying causes or factors."

Again, the actual knowledge we have of soil productivity and of fertilizers, likewise largely empirical, has been derived almost entirely from other sources than botany; and in the important discovery by Garner and Allard of the connection between the growth stimulating factor and the daily length of illumination, the approach to the problem and the progress in its solution "was purely from the agronomic viewpoint and with the object of solving an agronomic puzzle." This was used as an illustration of the fact that "the plant culturist gets a different contact with plant phenomena than does the botanist of the laboratory," and it was shown by numerous examples how different plant cultural problems are from those considered in the conventional botany of the schools. No revolutionary practice in agriculture is traceable to the efforts of botany as such, and the conclusion was reached that the latter "seems truly to have neglected its splendid opportunities in its adherence to the fetish of pure science."

Referring to the movement for a closer union of all scientific societies concerned with plants, which has reached a definite proposal for the organization of a broad American Plant Society, Prof. Piper felt that there is every reason for such closer union which would lead to better mutual understanding and reciprocal effort. "The complex and obscure factors involved in crop production need for their solution a far greater number of botanically trained investigators," he said; and he expressed the hope that botanists will more and more devote their energies to this field of investigation so vital to human welfare.

Prof. H. C. Cowles, in emphasizing the practical relations of ecology and its applications in the cultivation of plants, urged more attention to the study of what he called "plant science," and likewise suggested the collection of all the forces engaged in it in one large organization.

The holding of these joint sessions and the meeting of the Society of Agronomy with the American Association was therefore most

timely, and was accompanied by a considerable discussion of means for bringing together future meetings of these scattered but related interests in agricultural questions. It is suggested that the Section of Agriculture might form a logical nucleus around which such a grouping could be effected.

In its isolation there has been some confusion and doubt in the past as to what this section should embrace. It was designed originally to give recognition to the broad applications of science in relation to the agricultural industry, and was not intended to deal independently with matters which relate specifically to the subject matter covered by any other section or body of specialists. Without, therefore, infringing upon any other group by encouraging the presentation of results of technical investigation in the different branches of agricultural research, the section may fill a useful function by providing a place where problems of the industry resting on science can be considered in their broader aspects. It may thus furnish a forum where representatives of different branches of science may meet on a common ground to consider matters which have a common interest or bearing.

In the growth of specialization and the segregation that follows, there is danger that the scientist may be narrowed in the relations of his science and may become absorbed in it to the exclusion of contacts which must be established when the time comes for its application. It is wholesome also to see what men in related branches of science are thinking about and to get their reaction on the application of a finding or a theory. Without this there have already been some strange generalizations.

These advantages are peculiarly important in the case of a subject like agriculture in which questions are usually broader than individuals or even branches of science, and in which close contact between general science and the industry is essential. Whether those who are laboring in lines which have importance for agriculture are working singly and independently, or under some common plan of cooperation, there is great advantage in a conference of minds which guards against narrow provincialism and maintains a proper sense of proportion and balance.

It is becoming quite clear, therefore, that the Section of Agriculture can best serve as an agency for drawing together the various interests that center in agriculture, and giving these agricultural aspects more adequate expression in the national association of science. This view was emphasized by Dr. A. F. Woods in his vice-presidential address at Chicago, which dealt specifically with The Future of Agricultural Science in the American Association for the Advancement of Science. In this he showed the changed

attitude of general science toward economic subjects, well illustrated by the fact that research workers in the field of agriculture are now accepted on the merits of their work, and that the subject has been taken up by leading universities and the Rockefeller Foundation for Medical Research, as well as being incorporated with all biology in a division of the National Research Council. Since agriculture draws from all sciences and represents the chief economic application of several of them, he maintained that the Section of Agriculture "should be the largest and livest section of the Association," and should constitute the agricultural focus of it.

Dr. Woods' address served to crystallize in the minds of those present a view which has been gaining ground for some time, and led to the formulation of plans to carry out this purpose at the next meeting. This can be accomplished by arranging for joint sessions with appropriate sections or societies, which will offer opportunity for broader presentation and discussion.

The programs of the Section of Agriculture have been uniformly good from the start, and the one at the Chicago meeting contained much which persons interested in agricultural questions could ill afford to miss; but the conflict rather than the lack of interest has stood in the way of the section attracting the attendance it properly deserves. By making it a center for the many-sided consideration of broad topics in agricultural science, the meetings of the Association will be given a new interest to many and the section made more generally useful.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The ragweed pollen proteins, F. W. HEYL and H. H. HOPKINS (*Jour. Amer. Chem. Soc., 42 (1920), No. 8, pp. 1738–1743*).—In continuation of the senior author's study of ragweed pollen previously noted (E. S. R., 40, p. 607), analyses by the Van Slyke method are reported of the glutelin and albumin of the pollen and of two forms of proteoses, one isolated from the pollen by 5/10 to 10/10 saturation with ammonium sulphate and the other the entire fraction further purified by dialysis. Tyrosin was determined by the colorimetric method of Folin and Denis. The results obtained are summarized in the following table:

Amino acids in the ragweed pollen proteins.

Amino acid.	Proteose 5/10–10/10.	Proteose (entire) dialyzed.	Glutelin.	Albumin.
	Per cent.	*Per cent*	*Per cent.*	*Per cent.*
Arginin	1.48	2.08	4 69,4 7	6.15
Histidin	Absent	Absent	1.69,2.3	Absent
Lysin	3.70	4 48	7.66,6.6	8.76
Tyrosin	0.78	1 10	4 7	2.79,2 83
Tryptophan	Absent	Absent	Absent	Absent

The influence of the substrate concentration on the rate of hydrolysis of proteins by pepsin, J. H. NORTHROP (*Jour. Gen. Physiol., 2 (1920), No. 6, pp. 595–611, figs. 3*).—Continuing the studies on pepsin previously noted (E. S. R., 43, p. 611), evidence is presented that for any given concentration of pepsin the relative rate of digestion of concentrated and of dilute protein solutions is always the same. The rate of digestion and the conductivity of egg albumin solutions of different concentrations were found to be approximately proportional at the same H-ion concentration. This is explained on the hypothesis that the ionized protein is largely or entirely the form which is attacked by the enzyms. An increase in the viscosity of the protein solution was found to diminish the rate of digestion, probably on account of the retardation of the diffusion of the enzym.

On inulin in the globe artichoke, R. OKEY and A. W. WILLIAMS (*Jour. Amer. Chem. Soc., 42 (1920), No. 8, pp. 1693–1696*).—The authors report the results of proximate analyses of the edible portion of the globe artichoke (*Cyanara scolymus*) and estimations of its content in inulin. The average results of at least two check determinations of the usual constituents were as follows: Moisture 85.5 per cent, ash 1.1, crude fiber 2.4, protein 2.8, ether extract 1.4, and total carbohydrate (by difference) 6.8 per cent.

Estimations of inulin by the method previously described by the senior author (E. S. R., 41, p. 12) showed its presence to the extent of about 2.5 per cent.

Pectins in various plants, A. J. W. HORNBY (*Jour. Soc. Chem. Indus., 39 (1920), No. 14, p. 246T*).—The results are reported of determinations, by the

method of von Fellenberg (E. S. R., 40, p. 202), of the pectin content of different parts of fresh vegetables, fruits, seeds, and cattle feed.

Different parts of the same root varied in pectin content, more being found in the epidermal tissue than in the cortex. Exposure to light, as in sprouting, and mechanical injury to the tissues apparently have a tendency to increase the pectin content of the exposed or injured part. It is suggested that the pectin has a protective effect, especially against insect attack, possibly through the splitting off of methyl alcohol from the pectin by the digestive juices of the insect.

Fat associated with starch, T. C. TAYLOR and J. M. NELSON (*Jour. Amer. Chem. Soc., 42 (1920), No. 8, pp. 1726–1738*).—From a study of the question as to whether the fatty material present in the "refinery mud," occurring in the sugar liquid after the hydrolysis of cornstarch in the manufacture of glucose, is an inherent part of the starch itself or is extraneous matter accompanying the starch from the kernel, the following conclusions were drawn:

The major part of the fatty material present in starch can not be removed by solvents before hydrolysis. Hydrolysis of cornstarch freed of extraneous fat liberates fatty acids when hydrolysis has reached the erythrodextrin stage. The liberated fat is principally palmitic acid, but an unsaturated substance of unknown structure also occurs with it. It is thought that the palmitic acid is attached indirectly to the carbohydrate but directly to the unsaturated component.

Starches from other sources than corn were also found to contain combined fat in varying amounts.

Practical standardization by chemical assay of organic drugs and galenicals, A. B. LYONS (*Detroit: Nelson, Baker & Co., 1920, pp. 397*).—This manual consists of a selection, with references to the original literature, of chemical methods for the standardization of organic drugs and galenicals, together with a few biological methods of assay. The subject matter is treated in two parts. The first on General Principles and Procedures deals with preliminary operations in the assay of crude drugs, general methods of extraction and determination of alkaloids, routine procedures for the assay of alkaloidal drugs and galenical preparations, the constituents and general principles of assay of volatile oils, and the iodin absorption value of fixed oils and fats.

Part 2 on Details of Methods of Assay and Standardization of Individual Drugs outlines the methods for the standardization of special alkaloidal, nonalkaloidal, cathartic, and nonpotent vegetable drugs, essential oils, epinephrin and glandular extracts, organic principles and synthetics, carbohydrates, and digestive enzyms.

A brief note on recent advances in alkalimetry, a list of molecular formulas and weights of the substances treated in the previous chapters, and lists of apparatus and reagents required complete the volume.

A wash bottle furnishing a continuous stream, H. KLEIN (*Chem. Ztg., 44 (1920), No. 97, p. 599, fig. 1*).—By passing over the stopper of an ordinary wash bottle a stopcock with a suitable ring opening and attaching to the usual mouthpiece of the wash bottle a piece of rubber tubing which is brought up through the stopcock and terminates in a short piece of glass tubing serving as a mouthpiece, an arrangement is secured by means of which a continuous stream lasting for 30 or 40 seconds can be produced. This is accomplished by filling the flask nearly full with the wash water or liquid, opening the pinchcock, blowing through the mouthpiece for a second or two, and then closing the pinchcock. The device is recommended particularly for use with wash liquids from which there is danger of inhaling poisonous or hot gases.

Note on the use of alundum filtering crucibles, D. T. Englis (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, pp. 799, 800, fig. 1*).—Suggestions are given for the technique to be employed in the use of alundum in place of Gooch crucibles for filtering off cuprous oxid in the determination of reducing sugars.

Notes on the preparation of cupferron, D. R. Kasanof (*Jour. Indus. and Engin. Chem., 12 (1920), No. 8, p. 799*).—For securing a consistently good yield of phenylhydroxylamin for use in the preparation of cupferron, the author describes a method in which the phenylhydroxylamin is prepared from nitrobenzene with the use of amalgamated zinc dust.

A study of a decolorizing carbon, J. C. Bock (*Jour. Amer. Chem. Soc., 42 (1920), No. 8, pp. 1564–1569*).—The extent to which a decolorizing carbon removes nitrogenous and other constituents from biological fluids was investigated by analyses of urine before and after treatment with the vegetable carbon Norit. The procedure in most of the experiments consisted in shaking a measured quantity of urine (100 to 200 cc.) with a weighed amount (usually 5 per cent) of Norit and filtering after thorough mixing was accomplished. Determinations on samples of the untreated and treated urines included total, ammonia, and urea nitrogen, creatinin, uric acid, phosphates, and chlorids. Determinations were also made of the effect of Norit on pure glucose solutions of different strengths, of the effect of various amounts of Norit on urine, and of the comparative effects of commercial and washed Norit.

The total nitrogen was removed from the urine by Norit to the extent of about 15 per cent, with a proportional removal of ammonia and urea nitrogen. The loss in creatinin amounted to from 50 to 90 per cent, and uric acid was almost quantitatively removed. Phosphates were decreased in amounts varying from 12 to 39 per cent, but only a small percentage of chlorids was removed.

The decrease in glucose was comparatively small in sugar-containing urines, but was much higher in pure solutions of the sugar. It is pointed out that this indicates that when several solutes are present in a solution, each of them is adsorbed less than when they are present separately.

Contribution to the chemistry of phosphomolybdic acids, phosphotungstic acids, and allied substances, H. Wu (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 189–220, fig. 1*).—This contribution consists of an historical review of the literature on the phosphomolybdic and phosphotungstic acids, a classification of these acids with their properties and reactions, a discussion of the conditions of their formation, simple methods for the preparation and analysis of the more important complex acids, a theoretical consideration of the reduction of these acids with illustrative experiments, and suggested applications of their use in analytical chemistry. The applications, which involve the use of the mixed acids containing 1 part of P_2O_5 to 18 of MoO_3, include their use for the detection of minute quantities of copper and of phosphoric acid, for the colorimetric determination of phosphoric acid, and as inside indicators for oxidation-reduction titrations.

The use of organic solvents in the quantitative separation of metals.—III, The separation of magnesium from sodium and potassium chlorids, S. Palkin (*Jour. Amer. Chem. Soc., 42 (1920), No. 8, pp. 1618–1621*).—The author's method for the separation of lithium from the other alkali metals (E. S. R., 36, p. 505) has been adapted with slight modifications to the separation of magnesium from these metals.

"The method depends on the progressive precipitation of the sodium and potassium chlorids from a concentrated aqueous solution by the use of alcohol and ether and is divided into two stages, (1) in which all but a few milligrams are precipitated, and (2) in which the last few milligrams are removed from

solution. The method has several advantages, viz, (1) it affords a direct determination of the sodium and potassium chlorids in that they are precipitated first (rather than after magnesium, as in other methods), (2) the reagents used are readily volatile organic solvents, and (3) no foreign base or salts is introduced as a precipitating agent."

The detection of oxalic acid and lactic acid especially in distinction from tartaric acid, K. BRAUER (*Chem. Ztg., 44 (1920), No. 80, p. 494*).—As a delicate test for oxalic acid, the author recommends heating the dried substance with concentrated H_2SO_4 and resorcin. A deep violet color is produced, in marked contrast to the red color with tartaric acid under the same conditions. Similarly lactic acid can be distinguished from tartaric acid by the deep red color produced by the former on heating with resorcin and dilute H_2SO_4 (1:1), as compared with a yellow color produced by tartaric acid under the same conditions.

The colorimetric estimation of tyrosin by the method of Folin and Denis, R. A. GORTNER and G. E. HOLM (*Jour. Amer. Chem. Soc., 42 (1920), No. 8, pp. 1678–1692, figs. 3*).—The authors at the Minnesota Experiment Station report a quantitative study of the effect of various amino acids and other factors upon the development of the blue color in solutions containing the phenol reagent of Folin and Denis (E. S. R., 28, p. 805). The original directions for the use of this reagent were followed exactly with the exception that distilled water was used instead of tap water, 10 cc. of the reagent instead of 5 cc., and a Kober colorimeter instead of one of the Duboscq type.

The results of this study have led to the conclusion that tyrosin can not be quantitatively estimated in a protein hydrolyzate because tryptophan (and possibly other amino acids), indol and indol derivatives, and ferrous iron or apparently any other easily oxidizable material also react with the reagent to produce the color. In searching for an explanation of the opposite conclusion regarding tryptophan arrived at by Johns and Jones (E. S. R., 40, p. 113), it was noted that these authors decolorized their hydrolyzate with Norit. A study of the effect of this decolorizing carbon showed that it removed at least tyrosin, tryptophan, and tryptophan decomposition products in appreciable amounts, with the result that the color values by Johns and Jones were not the true color values for the hydrolyzates under investigation. It was also found that the acid washings of bone black gave an intense blue color with the phenol reagent, indicating that the bone black contains some easily oxidizable material, probably reduced iron, which dissolves in acid solution.

A study of the relation of the color intensity to the concentration of the reactive substance indicated that the amount of color which is developed in a solution is not a linear function of the concentration of the reactive material, but that the color values fall off sharply as concentration increases. This makes it necessary to know the approximate concentration of reactive material in advance of the colorimetric determination in order to develop maximum color values. Since solutions of tyrosin and tryptophan do not give the same color values at equivalent concentrations, it is impossible to measure accurately the sum of these amino acids even in a mixture which contains no other reactive substances.

Determination of iodin in connection with studies in thyroid activity, E. C. KENDALL (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 149–159*).—The author, with the assistance of A. Pugh, F. S. Richardson, and C. Fones, has modified the method of determining iodin described in an earlier publication[1] in order to make it applicable to the determination of iodin in blood and tissue.

[1] Jour. Biol. Chem., 19 (1914), No. 2, pp. 251–256.

The modifications consist essentially in using a specially reduced phosphoric acid for the blank determinations, substituting small lumps of hard coal for talcum for the removal of bromin from the solution, removing oxidizing agents other than iodic acid by boiling the fusion solution with an excess of sodium bisulphite, controlling the H-ion concentration of the solution by titrating to the first pink color with methyl orange, after which 5 cc. of 20 per cent phosphoric acid is added, substituting solid potassium iodid for the 10 per cent solution previously used, and controlling the length of time of boiling the solution.

The modified technique is described in detail, and determinations with iodin in the form of potassium iodid added to water are reported which indicate a high degree of accuracy in the determination of minute amounts of iodin.

Determination of iodin in blood and in animal tissues, E. C. Kendall and F. S. Richardson (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 161–170, figs. 3*).—This paper describes the application of the modified method noted above to the determination of iodin in blood and tissues.

The only additional requirement is the destruction of a large amount of organic matter without the loss of iodin. It was found that in the presence of about 3 gm. of sodium hydroxid for each 100 gm. of blood or tissue the water could be evaporated on a hot plate and the organic matter destroyed at a temperature between 300 to 400° C. without appreciable loss of iodin. The exact technique that must be followed is described, and illustrations are given of a special cylinder and hot air ovens used in the determination.

The incineration of organic matter for the analysis of its mineral constituents; application to the analysis of blood, A. Desgrez and J. Meunier (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 3, pp. 179–182*).—The method described consists in first heating the dried material until the volatile matter takes fire. By careful manipulation sufficient air is supplied to keep the flame burning until the volatile matter has been consumed. The residue left under such conditions contains the carbon in such a porous form that further combustion is said to take place readily at low incandescence without loss of volatile salts. The author states that by ashing horse blood in this way he has been able to identify in the ash, copper, manganese, and lithium.

Method for determination of calcium in small quantities of blood serum, B. Kramer and J. Howland (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 35–42*).—In the method described the blood serum (1 or 2 cc.) is ashed in the usual way, the ash dissolved in not more than 1 cc. of N/10 H_2SO_4, the solution transferred to a Pyrex tube calibrated for 1 and 2 cc., and the tube heated for a few minutes in a water bath with the addition of a drop of N/100 potassium permanganate to prove the absence of any oxidizable material. One drop of 0.01 per cent phenolsulfonphthalein is added, followed by one drop of concentrated ammonia. The tube is heated in the water bath to drive off the excess ammonia, and while still hot 3 cc. of N/10 oxalic acid in N/20 H_2SO_4 is added in three portions with shaking. This dissolves the fluffy precipitate first formed and forms a copious fine crystalline precipitate. If the reaction is not acid N/10 H_2SO_4 is added until the color is lemon-yellow. After continuing the heating for a few minutes the tube is cooled, 0.1 cc. of a saturated solution of sodium acetate is added, and the tube well shaken. The volume is made up to 2 cc., the tube allowed to stand several hours, and the material then filtered through hardened filter paper. To 1 cc. of the filtrate in a small beaker 1 cc. of 20 per cent H_2SO_4 is added, the beaker heated on the water bath for a few minutes, and the solution titrated in good daylight to a definite pink that persists for at least 30 seconds.

Results obtained by this method with solutions of known composition, with sera to which known amounts of calcium had been added, and with normal and

pathological sera are reported, and the principal sources of error in the determination of small quantities of calcium in the presence of magnesium and phosphates are discussed. It is claimed that the error in the determination of calcium in 2 cc. of serum does not exceed 3 per cent and may be less than 1 per cent.

Detecting artificial color in jams and jellies, C. H. CAMPBELL (*Canner, 51 (1920), No. 15, p. 37*).—As a method for detecting the addition of more highly colored juices of other fruits to produce a more satisfactory color in jams and jellies made from inferior materials, the author suggests testing a strong solution of the product with lead acetate solution. The color of both the precipitate and filtrate is thought to be an indication of the purity of the product. A table is given of the colors produced with lead acetate and jellies of known composition.

The prevention of sugar deterioration by the use of superheated steam in centrifugals, N. KOPELOFF (*Jour. Indus. and Engin. Chem., 12 (1920), No. 9, pp. 860–862, fig. 1*).—By means of an apparatus devised by W. G. Taggart for use in laboratory centrifugals, the author has been able to make controlled experiments on the use of superheated steam in centrifugals to sterilize the massecuite and thus prevent subsequent deterioration of the sugar. The experimental work reported consisted in preparing a massecuite of medium density from confectioners' crystals coated with a blackstrap molasses which had been heavily inoculated with molds and with the bacterial colonies developing from 150 plates poured from Cuban raw sugar. A massecuite of medium density was prepared, heated to 40° C. for about 10 minutes, and poured into the centrifugal basket until it formed a layer 0.75 in. deep. The autoclave was run up to 22 lbs. pressure, the centrifugal put in operation, and steam from the autoclave turned on for 3 minutes. After cooling, samples of the sugar and molasses were then taken in sterile containers, plated out in three dilutions on Kopeloff's agar, incubated at 30°, and read after 3 and 7 days.

The treatment was found to reduce the bacterial content of the sugar from 93 to 99.5 per cent and the number of mold spores from 92 to 98 per cent. The bacterial and mold counts of the molasses were reduced 84.34 and 50 per cent, respectively. The factors influencing the extent of destruction of the organisms in this process are considered to be temperature of steam, duration of application, thickness of layer of massecuite, and speed of centrifugal. It is thought that under mill conditions where higher temperatures are available even better results might be obtained than the experimental results reported.

Attention is called to the conclusion previously drawn (E. S. R., 43, p. 807) that the two factors, moisture ratio and degree of infection, operate simultaneously in influencing the keeping qualities of sugar, and it is pointed out that with the striking reduction in mass infection that can be brought about by the use of superheated steam in the centrifugal, the keeping quality of the sugar may be greatly enhanced even if the moisture content of the sugar is somewhat high. It is emphasized, however, that sugar must be properly handled under sanitary conditions in order to insure its safe keeping, since even under the best conditions the microorganisms soon propagate rapidly enough to become detrimental.

The prevention of sugar deterioration, N. and L. KOPELOFF and C. J. WELCOME (*Louisiana Stas. Bul. 175 (1920), pp. 3–58, fig. 1*).—This bulletin consists of the reports of several studies concerning the prevention of sugar deterioration as follows:

I. *The prevention of sugar deterioration by the use of superheated steam in centrifugals.*—Noted above.

II. *The deterioration of Cuban raw sugars in storage.*—Previously noted (E. S. R., 43, p. 616).

III. *Further studies in the deterioration of a variety of sugars in storage.*—This is an extension of the investigation noted in part 2, the technique and procedure being the same except that the position of the bags in any single pile was reversed after four weeks' incubation to obtain uniformity of environment, and the bags were placed on scantling 1 ft. from the floor and protected by a covering of a single layer of sacks. A large variety of sugars was selected, furnishing all extremes in polarization, moisture, and number of microorganisms.

The results obtained in the chemical and bacteriological analyses of the sugars at the beginning and after four and eight weeks, respectively, corroborate the earlier findings of loss in polarization, gain in reducing sugars and moisture content, and gain in the number of microorganisms per gram. A large initial infection or rapid multiplication of microorganisms was responsible for an increase in deterioration.

IV. *The formation of the gum, levan, by mold spores. Identification and quantitative determination.*—The gum formed from sucrose solutions by enzyms contained in *Aspergillus sydowi* was isolated and identified as levan. To determine true sucrose in the presence of a gum such as levan the invertase method was found to give more accurate results than the Clerget method. It is pointed out that the difference in polariscope readings after Clerget and invertase inversion in a sucrose solution containing levan is a measure of the levan present.

V. *The formation of the gum, levan, by mold spores. Mode of formation and influence of reaction.*—To determine the mode of formation of the gum levan in sucrose solutions 50 cc. of sucrose solutions of varying concentration, with and without the addition of pure dextrose and levulose, were inoculated with 10 cc. of mold spores with and without the addition of 2 cc. of invertase. The solutions were made up to equal volume with sterile distilled water, incubated for one week at 45° C. and then analyzed for acidity, sucrose by single polarization, and reducing sugars and gums by precipitating with alcohol in alkaline solution and weighing upon tared filter papers. From the data thus obtained the conclusion was drawn that levan is formed by levanase from the mold spores most readily from nascent dextrose and levulose (obtained by the action of invertase on sucrose). In the absence of sucrose and nascent reducing sugars, slight gum formation was obtained with c. p. reducing sugars. Levan is not formed directly from sucrose, but may be formed when sucrose undergoes inversion. Appreciable concentrations of acidity or alkalinity inhibit the action of levanase. The optimum reaction appeared to be at an H-ion concentration of pH=7.

VI. *Practical deductions.*—As practical deductions from this investigation, the authors recommend that rigid sanitary methods be employed in the sugar factory from the time the massecuite leaves the vacuum pan, that superheated steam be used in the centrifugals instead of wash water, and finally that a cool, well ventilated warehouse be used for storing the sugar.

Chemical problems of the beet sugar industry, H. W. DAHLBERG (*Chem. and Metall. Engin., 23 (1920), No. 10, pp. 421–424, figs. 4*).—This is a general discussion of the chemical problems involved in the beet sugar industry, with suggestions as to the lines along which scientific research is needed, particularly for the development of a process for the more complete utilization of beet sugar molasses.

Notes on sugar beet sirup, A. GRÉGOIRE (*Ann. Gembloux, 26 (1920), No. 6. pp. 265–271*).—The author advocates a more extended use of sugar beet sirup, particularly on account of its richness in potassium salts.

How beet sugar is made, J. W. Ames (*Mo. Bul. Ohio Sta., 5 (1920), No. 7, pp. 202–204*).—This is essentially an attempt to discourage the growing of sugar beets for the home manufacture of sirup. Attention is called to the unpleasant flavor and odor of raw beet sugar and molasses as compared with the corresponding sorghum products and to the elaborate processes and extensive equipment necessary for the production of beet sugar of suitable purity.

"The experience of those who have tried to make sirup by boiling down the juice obtained by soaking the sliced, washed beets in water has been unsatisfactory. The sirup obtained was a dark colored, sticky mass, with a disagreeable taste and odor."

The manufacture of sorghum sirup, C. E. Thorne (*Mo. Bul. Ohio Sta., 5 (1920), No. 7, pp. 199–201, figs. 2*).—Brief directions are given for the manufacture of sorghum sirup on a small scale, including harvesting and caring for the cane, construction of the mills and evaporators, and the handling of the juice and sirup.

The manufacture and use of peanut butter, H. C. Thompson (*U. S. Dept. Agr., Dept. Circ. 128 (1920), pp. 16, figs. 6*).—This circular consists of a brief description of the commercial manufacture of peanut butter, together with suggestions for its home manufacture with the use of an ordinary meat grinder. A few recipes for the use of peanut butter are contributed by the Office of Home Economics.

Practical points in the manufacture of tomato catsup, C. A. Campbell (*Canner, 51 (1920), No. 12, pp. 35–37*).—A brief discussion is given of certain points which should be considered in the manufacture of tomato catsup. Some of the suggestions given, particularly in regard to cooking and spicing, are of equal application in the home preparation of catsup.

The influence of vinegar eels on the composition of vinegar, N. Passerini (*Bol. Soc. Ital. Studio Aliment., 2 (1920), No. 1–2, pp. 1–5*).—Samples of vinegar of low initial acidity (2.8 per cent calculated as acetic acid) were treated as follows: One sample was sterilized, three were sterilized and then inoculated with vinegar eels, two were simply filtered, and one was inoculated with the eels. All samples were stored under like conditions for 11 months and then analyzed for acidity, dry extract, and ash.

The original acidity was maintained in the sterilized samples, was decidedly decreased in the filtered samples containing no vinegar eels, and was increased in all samples containing the eels. Observations during the period of storage had shown that in the tubes containing vinegar eels a light film of the mother of vinegar persisted on the surface of the vinegar, while in those containing no eels the film grew rapidly and finally settled to the bottom of the tube. In explanation of these observations, the author concludes that the vinegar eels prevent too rapid growth and settling of the mother of vinegar and thus assist in the normal surface oxidation of the vinegar, while the submerged mother of vinegar brings about the decomposition of the acetic acid into carbon dioxid and water.

Conversion of walnut shells into poultry charcoal in a rotary kiln, H. L. Glaze and R. B. Stringfield (*Chem. and Metall. Engin., 23 (1920), No. 9, p. 368*).—The authors suggest the practical utilization of walnut shells in the manufacture of charcoal for poultry. It has been found possible to produce the charcoal economically in a rotary kiln, such as is used for the incineration of kelp for the recovery of its potash. A description of the plant and method of operation is given, together with details of the present cost of operation. Test runs on apricot, peach, and prune pits, and on ordinary sawdust and shavings having given good results, the charcoal varying with the material.

METEOROLOGY.

Damage to crops by weather, J. W. SMITH (*U. S. Mo. Weather Rev., 48 (1920), No. 8, p. 446*).—The following table, compiled from data published annually by the Bureau of Crop Estimates of the Department, gives the average damage from different causes for the period from 1909 to 1919, inclusive, except for apples and berries, which covers the period 1912–1919:

Damage to crops from different causes.

Crop.	Deficient moisture.	Excessive moisture.	Floods.	Frost or freeze.	Hail.	Hot winds.	Storms.	Total weather.	Plant disease.	Insect pests.	Animal pests.	Defective seed.	Total.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Wheat	12.4	2.0	0.3	4.5	1.1	2.0	0.3	22.9	2.7	2.1	0.2	0.2	28.8
Corn	16.8	4.0	.9	2.9	.4	2.2	.5	27.7	.2	2.7	.2	.7	32.1
Oats	13.4	2.7	.3	.8	.8	1.9	.4	20.8	1.7	.9	.1	.2	21.5
Barley	17.1	1.8	.1	.8	1.3	3.2	.4	24.9	1.7	.7	.3	.1	28.7
Flax	21.1	1.3	.1	4.0	1.7	3.0	.2	31.8	2.2	.9	.1	.3	36.4
Rice	6.7	3.1	1.5	.3	(1)	.4	1.8	14.1	1.2	.8	.3	.1	19.0
Potatoes	14.4	3.1	.2	1.6	.1	.7	.1	20.7	4.4	3.2	.1	.3	30.0
Tobacco	8.7	3.7	.6	1.1	.8	.2	.3	15.8	.4	2.6	.....	.1	20.5
Hay	13.4	1.7	.3	1.7	.1	.6	.2	18.4	.1	.5	.1	.1	20.4
Apples	5.4	1.6	.2	14.6	.8	.5	.9	21.9	3.7	3.6	.1	......	39.6
Berries	9.3	1.7	.2	7.3	.5	.6	.2	20.3	1.1	.6	.1	......	24.9
Cotton	12.3	4.3	1.0	1.4	.5	1.6	.7	22.3	2.0	9.7	(1)	.2	35.5

[1] Less than 0.05 per cent.

"It will be noted that a very large part of the total damage or loss is due to unfavorable weather; also that deficient moisture is the greatest single damaging factor in connection with every crop, except apples. Low temperature causes nearly three times as much damage to apples as dry weather."

Mathematical inquiry into the effect of weather on corn yield in the eight corn-belt States, H. A WALLACE (*U. S. Mo. Weather Rev., 48 (1920), No. 8, pp. 439–446*).—This paper gives the results of a rather detailed study, by means of correlation coefficients, multiple coefficients of correlation, and lines of regression, of the relation between corn yield, rainfall, and temperature during the months of May, June, July, and August in each of the eight corn-belt States, with special reference to Smith's conclusion (E. S. R., 31, p. 229) that "if the rainfall for calendar months be considered, that for July has a far greater effect upon the corn yield than rainfall for any other month." The period studied in each State is 29 years, 1891–1919.

The general conclusion reached is that "July rainfall, while a dominating factor in determining corn yield in Ohio, is not such a dominating factor in many of the other corn-belt States, and in northern Iowa especially July rainfall ordinarily has very little influence on corn yield. Each State is a specific problem in itself, and the probabilities are that each county in a State is a specific problem. . . .

"Careful examination of the rainfall, temperature, and corn yield data in the various corn-belt States leads to the belief that while the method of correlation coefficients is very useful for preliminary examination of the data, and while this method gives fairly good predicting formulas in the southern part of the corn belt, yet it is not at all well adapted to the northern part of the corn belt, and especially to northern Iowa. The relationship between corn yield and July

temperature, for instance, is not strictly linear but more in the nature of a horseshoe curve. For instance, when the July temperature is 68° F. the yield may possibly tend to be 6 per cent above normal; when it is 69° the yield may tend to be 13 per cent above normal; when it is 70° the yield may tend to be 14 per cent above normal; when it is 71° the yield may tend to be 15 per cent above normal; when it is 72° the yield may tend to be 13 per cent above normal; when it is 73° the yield may tend to be 12 per cent above normal; when it is 74° the yield may tend to be 10 per cent above normal; when it is 75° the yield may tend to be 8 per cent above normal; when it is 76° the yield may tend to be 6 per cent above normal; when it is 77° the yield may tend to be 4 per cent above normal; when it is 78° the yield may tend to be 2 per cent above normal; when it is 79° the yield may tend to be 2 per cent below normal. (This is when the rainfall is constant.)

"July rainfall and corn yield also apparently tend to have a relationship of somewhat this type, a rain of more than 4.5 in. in July ordinarily doing little if any more good than a rainfall of 4 in. In fact, in some years exceedingly heavy July rains seem to have done harm in northern Iowa. Practically none of the weather factors has a strictly linear relationship to corn yield. In the case of May temperature, for instance, a temperature of less than 54° is apparently very severely damaging in the north-central part of the corn belt, much more damaging than a straight line of regression would indicate. In years when the May temperature is 6 or 7° below normal it is probable that the yield is cut 20 per cent or 25 per cent below normal, whereas the method of a straight line of regression would indicate a cut of only about 7 per cent below normal. When the temperature is only 2° below normal, however, it is doubtful if the corn yield is really affected by as much as the 2 per cent which the line of regression would indicate."

Weather and corn, 1920 (*U. S. Dept. Agr., Natl. Weather and Crop Bul., No. 41 (1920), pp. 2, 8, figs. 6*).—Diagrams which show "the normal and average rainfall and departure of temperature from the normal by sections for each week of the growing season of 1920 in the principal corn States, and the condition of the corn crop on the first of July, August, and September" are given and discussed.

Weather and cotton, 1920 (*U. S. Dept. Agr., Natl. Weather and Crop Bul., No. 42 (1920), pp. 2, 3, 7, figs. 6*).—Diagrams which show "the normal and average rainfall and departure of temperature from the normal by sections for each week of the growing season of 1920 in the principal cotton States, and the condition of the cotton crop on the twenty-fifth of May, June, July, August, and September" are given and discussed.

Smudging as a protection from frost, H. H. KIMBALL and F. D. YOUNG (*U. S. Mo. Weather Rev., 48 (1920), No. 8, pp. 461, 462*).—Summarizing the results of measurements of radiation in tests of orchard heaters at Washington, D. C., Pomona, Calif., and Medford, Oreg., the authors conclude that "the presence of a dense smoke cloud diminishes nocturnal radiation on an average about 0.011 calorie per minute per square centimeter of surface, with maximum effects of nearly 0.03 calorie. At a distance of 10 ft. the intensity of radiation from a lard-pail heater is about 0.08 calorie per minute per square centimeter; from a short-stack heater, about 0.1 calorie; from a high-stack heater when just turning red, 0.12 calorie; and when completely red, from 0.25 to 0.3 calorie.

"Since the intensity of radiation varies inversely as the square of the distance from the source of heat, at a distance of 15 ft. from the heaters it will be less than half, and at 20 ft. about one-fourth that given above. The heat-

ing by radiation is in addition to the heating by conduction and convection of hot air and gases from the burning oil and its immediate vicinity.

"We must therefore conclude that the retardation of nocturnal radiation by the smoke cloud plays an insignificant part in frost protection."

Hailstorms in Nebraska, H. G. CARTER (*U. S. Mo. Weather Rev., 48 (1920), No. 7, pp. 397, 398, pls. 2; extract in Bul. Amer. Met. Soc., 1 (1920), No. 10, p. 118*).—"From a study of all available hailstorm records from 150 cooperative Weather Bureau stations and the regular Weather Bureau stations in Nebraska it was found that the average number of hailstorms during the season April to September, inclusive, was 3.2. Hailstorms are most frequent in May and least frequent in September. The greatest number of hailstorms occur about a month later than the time of greatest rate of temperature increase in spring. The greatest number of thunderstorms is in June and the fewest in April. Although hail does not occur without a thunderstorm, but 7.2 per cent of all thunderstorms is accompanied by hail. The percentage is largest in April and least in August. . . .

"The general movement of hailstorms is from a westerly to an easterly direction. The path over which hail falls is usually of limited area. It is, in fact, quite common for the crops over but a small area to be damaged. This must not be misconstrued to mean, however, that this particular small area suffers loss year after year.

"Hailstones of unusual size have been reported from various sections of the State. Authentic reports of hailstones as large as hens' eggs are not unusual, while occasionally hailstones even larger are reported. . . . Hailstones of this size kill small animals and birds, literally pound the crops into the ground, strip small branches from trees, break windows, and even damage the walls and roofs of frame buildings. Great destruction is sometimes left in the path of such a storm. Fortunately, however, storms of this intensity are the exception rather than the rule in Nebraska."

A simple equation of general application for the normal temperature in terms of the time of day and the day of the year, F. L. WEST (*U. S. Mo. Weather Rev., 48 (1920), No. 7, pp. 394–396; extract in Bul. Amer. Met. Soc., 1 (1920), No. 10, p. 118*).—From studies supplementing those previously reported (E. S. R., 42, p. 805), the author concludes that "the following empirical equation

$$T = \frac{Ma}{2} + Va \cos t + \frac{My}{2} \cos \theta$$

represents the normal temperature as a function of the time for the United States except for the arid West, where we must add the term $\left(\frac{Vv}{4} \cos t \cos \theta\right)$. The constants are the mean annual temperature, the range of the annual march, and the range of the daily march, and are obviously easily obtained from the Weather Bureau data for the place desired. The mean error for the arid West was 2.75° F. and it is less for the rest of the United States. The equation simply assumes that the annual and daily march of temperatures are simple cosine functions."

It is pointed out that "in using this equation for the determination of minimum temperatures at smudging time it should be remembered that even though a frost usually occurs on a clear night when the thermograph record is likely to be uniform yet the frosts that do damage to crops are usually abnormal, following cyclones, while the equation gives normal temperatures. These

normals from the equation, considered with the observed departures from the normals during the preceding 24 hours, should give a fairly accurate prediction of the minimum to be expected. The equation gives the most accurate results in the spring and fall when the damaging frosts occur because the time of sunrise at these seasons is about the mean for the year, and this mean is used in the equation."

Effect of topography on temperature distribution in southern California, F. D. YOUNG (*U. S. Mo. Weather Rev., 48 (1920), No. 8, pp. 462, 463, figs. 2; extract in Bul. Amer. Met. Soc., 1 (1920), No. 11, p. 136*).—This is the author's abstract of observations which are recorded more fully in an article previously noted (E. S. R., 43, p. 417).

Monthly Weather Review (*U. S. Mo. Weather Rev., 48 (1920), Nos. 7, pp. 379–438, pls. 16, figs. 13; 8, pp. 439–493, pls. 15, figs. 18*).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for July and August, 1920, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 7.—The Aurora of March 22–25, 1920, and Associated Displays (illus.), by C. F. Brooks and H. Lyman; Note on the Height and Location of the Aurora Spots and Belt of March 24, 1920, by C. F. Brooks and C. L. Meisinger; Auroras of 1919 in the United States, by H. Lyman; A Simple Equation of General Application for the Normal Temperature in Terms of the Time of Day and the Day of the Year, by F. L. West (see p. 120); Hailstorms in Nebraska (illus.), by H. G. Carter (see p. 120); Large Hailstones at Kansas City, Mo., May 14, 1898 (illus.), by P. Connor; Funnel Cloud over Lake Michigan, June 29, 1920 (illus.), by A. H. Ward; A Smoke Arch Marking an Increase in Wind (illus.), by A. H. Ward; Some Flying Experiences in "Bumpy" Weather in Texas, by D. P. Carlberk; Southerly Winds at High Altitudes over Lansing, Mich., during Sleet Storms of January, 1920, by C. G. Andrus; Exposed Steel Temperatures in the Tropics (illus.), by H. G. Cornthwaite; Diurnal Pressure Change in Gulf of Fonseca, by E. S. Jackson; The Climate of Japan and Formosa (illus.), by E. M. Sanders (see p. 122); and Historical Note on Charts of the Distribution of Temperature, Pressure, and Winds over the Surface of the Earth (illus.), by E. W. Woolard.

No. 8.—Mathematical Inquiry into the Effect of Weather on Corn Yield in the Eight Corn Belt States, by H. A. Wallace (see p. 118); Damage to Crops by Weather, by J. W. Smith (see p. 118); Weather and Crops in Arkansas, 1819 to 1879, by W. C. Hickmon; Hailstorm at Lehi, Utah (illus.), by J. C. Alter; Lightning Photographs (illus.); Lightning Injury in a Potato Field (illus.), by E. S. Johnston; Standing Wheat Fired by Lightning, by E. L. Wells; Lightning and Forest Fires, by A. H. Palmer; A Hot Squall on the Maine Coast, by R. M. Dole; Notes on Cloud Photography (illus.), by W. S. Davis; Apparatus and Methods for Cloud Photography (illus.), by A. J. Weed; Cumulus Cloud over Fire, by O. Neumer; Tables of Sunspot Frequency for the Years 1902–1919 (illus.), by A. Wolfer; Smudging as a Protection from Frost, by H. H. Kimball and F. D. Young (see p. 119); Effect of Topography on Temperature Distribution in Southern California (illus.), by F. D. Young; and The Principle of the Conservation of Angular Momentum as Applied to Atmospheric Motions (illus.), by H. W. Clough.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 6 (1919), No. 13, pp. [360], pls. 24, figs. 26*).—Summaries and detailed tabulated statements of climatological data for the year 1919 are given for each State.

Weather review for 1918 and 1919, H. D. Edmond (*Connecticut Storrs Sta. Rpt. 1918–19, pp. 177–188*).—Observations at Storrs, Conn., on temperature, precipitation, and length of growing season are summarized in tables and briefly discussed.

The mean annual temperature for 1918 was 47.3° F. and the annual precipitation 38.5 in. The growing period extended from April 25 to October 19, 176 days. The mean annual temperature for 1919 was 50.28° and the annual rainfall 40.56 in. The growing period extended from April 27 to October 9, 165 days. The annual temperature of 1918 was normal, the rainfall 3.95 in. less than normal. The annual temperature of 1919 was 2.9° below normal and the rainfall 3.24 in. less than normal.

Meteorological observations [at the University of Maine, Orono], J. S. Stevens (*Maine Sta. Bul. 284 (1919), pp. 306, 307*).—A tabular summary is given of monthly and annual temperature, precipitation, cloudiness, and wind during 1919. The mean temperature for the year was 42.15° F., as compared with 42.73° for 51 years; the precipitation was 30.56 in., as compared with a 51-year mean of 39.76 in. The snowfall was 39 in., the number of clear days, 217.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander and H. W. Poole (*Massachusetts Sta. Met. Buls. 381–382 (1920), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during September and October, 1920, are presented. The data are briefly discussed in general notes on the weather of each month.

Climatic conditions [on the Umatilla Reclamation Project], H. K. Dean (*U. S. Dept. Agr., Dept. Circ. 110 (1920), pp. 6–8*).—A record is given of observations during 1919 on temperature, precipitation, evaporation, and wind velocity at the experiment farm, and on length of growing season at Hermiston, Oreg. (1909–1919), and the data are briefly discussed and compared with the 7-year averages. Fruit was largely killed by spring freezes.

The climate of Japan and Formosa, E. M. Sanders (*U. S. Mo. Weather Rev., 48 (1920), No. 7, pp. 404–408, pls. 4, figs. 6*).—This is a rather detailed description of the climate of Japan and Formosa, based upon over 30 years' observations in Japan and nearly 20 years' observations in Formosa.

"From the point of view of the agriculturist the Japanese Empire is divided into four climatic zones by the winter isotherms. In the northern part the ground is frozen during the winter and only the summer is available for the crops, so that north of January isotherm 32° F. can be marked off as the northern zone. As one goes southward winter wheat becomes possible, and in the southern part of the central zone two crops a year are the regular order of things, wheat in winter and rice in summer, therefore a central zone between 32 and 40° can be defined. The south of Japan is semitropical, and as many as three crops a year are being raised; this may be termed the southern zone. Formosa, being tropical, stands by itself as the fourth climatic zone.

"Variations in the rainfall due to the varying direction of the prevailing winds, and difference in the frequency of the cyclonic storms, make necessary certain subdivisions of the two northern of the agriculturist's zones. The northern zone may be divided into an extreme northern division, with Nemuro as its type, where the rainfall is scanty, and a southerly division with Hakodate as the type, where the rainfall is greater, and the variability, both in rainfall and temperature, is more pronounced. On the other hand, the central zone is divided by a north-south line, into an eastern region which gets sum-

mer rain, and a western region which gets winter rain. The other two zones of the agriculturist remain unchanged."

These climatic zones are described and temperature and rainfall graphs of typical places in each are given.

SOILS—FERTILIZERS.

Soil investigation work in America, W. G. OGG (*Scot. Jour. Agr., 3 (1920), No. 3, pp. 287–295*).—A review is presented of soils work in the U. S. Department of Agriculture and in the State experiment stations from the British viewpoint, and a comparison drawn with the relatively inextensive work of a similar nature in progress in Great Britain, especially Scotland. Special attention is drawn to the soil survey work conducted by the Bureau of Soils, and the need of similar work in Scotland is brought out.

Chemical analysis of soils, F. E. BEAR (*Mo. Bul. Ohio Sta., 5 (1920), No. 8, pp. 227–231*).—It is pointed out that chemical soil analysis is valuable (1) as a guide in planning permanent systems of soil improvement, (2) as an index of the direction of change of amount of plant nutrients in soils, (3) as a basis for interpretation of experimental data from different soils, (4) as a guide to the use of results from experimental farms, and (5) as an indicator of potential fertility in soil. It is considered that from the viewpoint of scientific research in soils chemical analyses are indispensable.

Soil survey of Cheyenne County, Nebr., H. C. MORTLOCK ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 39, fig. 1, map 1*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 764,160 acres in southwestern Nebraska, which lies in the high plains division of the Great Plains province. The topography varies from flat on the high table land and in the stream valleys to rough and dissected in the areas of rough broken land. Drainage is well established except in depressions on the upland and in portions of certain flood plains.

The soils are of residual and alluvial origin. Including rough broken land, 17 soil types of 7 series are mapped, of which the Rosebud silt loam and Rosebud loam cover 45.5 and 22.7 per cent of the area, respectively.

Studies of a Scottish drift soil, I–III, W. G. OGG and J. HENDRICK (*Jour. Agr. Sci. [England], 7 (1916), No. 4, pp. 458–469; 10 (1920), No. 3, pp. 333–357, figs. 5*).—Studies of the composition and mineral particles of a glacial drift soil typical of much of the agricultural land of northern Scotland, as conducted at the University of Aberdeen, are reported.

This soil was found to be composed largely of particles which have not undergone profound chemical weathering, but which consist of the original granitic minerals mechanically ground with only comparatively superficial chemical alteration. The coarser particles comprising a large part of this soil are well supplied with lime, potash, soda, and magnesia.

Studies of the absorptive power of this soil and its mechanical fractions showed it to have a considerable absorptive power for ammonia from a solution of ammonium sulphate. The absorptive power per unit weight of the fractions increased with the decrease in size of the particles, reaching a maximum in the case of clay. Fine silt and silt also had a high absorptive power. It seemed probable that the absorptive power was not determined by surface alone but that the chemical composition of the fractions had an influence thereon. With reference to distribution of the absorptive power among the various fractions, it was found that the fine silt and the silt took a large share in the total absorption.

A comparison of the absorptive power of this soil with that of powdered granite showed that the granite fractions have a similar power of absorbing ammonia. It appeared that absorption is not due to weathered materials alone but also to unweathered materials. It was found that the absorption did not increase proportionately to the increase of the surface with fractions of increasing fineness but at a lower rate than the increase of surface. After ignition there was a reduction in the absorptive power, and this reduction was more marked in the case of the soil fractions. The absorbed ammonia was only gradually washed out by water, but the whole of it was not removed in this way, a point being reached when practically no more ammonia was removed.

It is concluded that absorption by powdered granite and probably also by the unweathered or little weathered materials in soils is largely an adsorption effect.

The peat resources of Ireland, P. F. PURCELL (*[Gt. Brit.] Dept. Sci. and Indus. Research, Fuel Research Bd., Spec. Rpt. 2 (1920), pp. 25, pls. 3*).—The peat resources of Ireland are described and discussed, with particular reference to their utilization as fuel and for producer work.

A note on the sheraqui soils of Egypt.—A study in partial sterilization, J. A. PRESCOTT (*Jour. Agr. Sci. [England], 10 (1920), No. 2, pp. 177–181, fig. 1*).—Two years' studies of the so-called sheraqui or summer fallow soils of Egypt gave evidence characteristic of partial sterilization.

The formation of soluble substances in soils taken from widely separated regions, M. M. McCOOL and C. E. MILLAR (*Soil Sci., 10 (1920), No. 3, pp. 219–235, fig. 1*).—Studies conducted at the Michigan Experiment Station on the comparative rates of formation of soluble substances in surface and subsoils collected from widely separated areas in the United States, including 14 States, are reported.

It was found that soils formed under conditions of low precipitation are not necessarily more soluble than those that have proceeded somewhat further in their weathering. Samples of soil taken from formations that have undergone extreme weathering were found to be very inert. It is thought, therefore, that so-called new soils are less active than those somewhat older, and that aged soils are almost inert. The subsoils taken from all the regions formed soluble salts very slowly. Studies on the soluble-salt content of soils at the station at different depths and periods of the growing season have also shown that there is little activity in field soils below 6 in. in that vicinity.

Studies of the activities of soil separates isolated from a number of soils showed that the finer separates, silt and clay, are responsible chiefly for the formation of soluble salts in these soils. The sandy particles were found to be very inactive. Grinding the separates measurably increased their solubility. Usually only slight increases in the material going into solution were observed after the first 24-hour period. When thte separates were treated with 0.1 N sodium nitrate and then washed until free of soluble material, the rate of formation of soluble substances was measurably affected, those from the western soils responding somewhat more than the others.

Lysimeter investigations [at the Umatilla (Oreg.) Reclamation Project Experiment Farm], H. K. DEAN (*U. S. Dept. Agr., Dept. Circ. 110 (1920), pp. 19, 20, fig. 1*).—Lysimeter investigations with fine, medium, and coarse sand, silt, and silt loam soils growing different crops, manured and unmanured, are reported.

The percolation from the medium sand was the greatest when uncropped, followed in order by plats cropped to soy beans, vetch, alfalfa, and manured

alfalfa. The percolation from the other soils growing alfalfa was the greatest from coarse sand, followed by medium and fine sand. The silt and silt loam soils held all the water applied to them. The results indicate a tendency for percolation to decrease as the soils are cropped continuously.

Aluminum as a factor in soil acidity, J. J. MIRASOL (*Soil Sci., 10 (1920), No. 3, pp. 153–217, figs. 21*).—Experiments conducted at the University of Illinois are reported, (1) to determine the influence of aluminum salts and aluminum hydroxid alone and in combination with calcium carbonate or acid phosphate on the growth of sweet clover in sand, (2) to determine the influence of limestone and acid phosphate alone and in combination on the productivity and reaction of gray, yellow gray, and yellow silt loam soils, all of which were acid, (3) to determine the effect of the removal of some of the aluminum from soil on the growth of sweet clover, and (4) to ascertain whether iron and manganese also are factors in the acidity of these soils.

It was found that, in the absence of some calcium compounds as a source of calcium, aluminum salts were highly toxic to sweet clover when applied in amounts chemically equivalent to the acidity of the soil, and fatal to sweet clover when applied in amounts chemically equivalent to five times the acidity of the soil. In the presence of calcium silicate, aluminum nitrate was more toxic than aluminum sulphate. Aluminum monohydroxid had no effect whatever on the growth of sweet clover when other plant-food elements were added in water-soluble form. Calcium carbonate in sufficient amounts corrected the toxicity of aluminum salts by precipitating aluminum as calcium aluminate. Acid phosphate applied at the rate of 400 lbs. per acre reduced the toxicity of aluminum salts by forming aluminum phosphate.

Limestone applied at a rate equal to the lime requirement produced good crops on the three silt loam soils; applied at the rate of five times the lime requirement it produced better crops. At the same rate of application the soils were alkaline at the end of 178 days. Acid phosphate applied alone at the rate of 1 ton per acre produced fair crops and at the rate of 5 tons good crops. It also reduced the acidity of the soils, the decreases in acidity depending on the rate of application. At the rate of 5 tons per acre acid phosphate reduced the acidity from 51 to 57 per cent. The combination of acid phosphate and limestone in large quantities produced the best crops.

When the soil was leached out with potassium nitrate solution until the last 125 cc. of leachings were practically neutral, the acidity of the soil was reduced 99 per cent and as much as 59 per cent of the aluminum was leached out. Sweet clover growing on leached soil was better than that growing on unleached soil. This is thought to prove conclusively that aluminum is the determining factor in the acidity of the soils under investigation and probably of most other acid soils of the same origin.

A bibliography is appended.

Fall plowing v. spring plowing for North Dakota grain crops, H. L. WALSTER (*North Dakota Sta. Bul. 141 (1920), pp. [4], figs. 8*).—Mechanical analyses are reported, the purpose of which was to determine the relative values of fall and spring plowing under different conditions in North Dakota.

It was shown that fall plowed land contained more fine crumbs and less clods than spring plowed land, and it is pointed out that no amount of packing of soil containing so many coarse lumps as the spring plowed land could ever bring about the desired closeness of contact between seed and soil. It has also been found, however, that under western North Dakota conditions spring plowing has given slightly better average results than fall plowing for all crops except wheat.

On soils at all inclined to drift, such as sands, fine sands, light loams, and fine sandy loams, fall plowing is a very doubtful practice. These soils should be seeded to winter rye or covered with straw or manure if plowed in the fall.

Nitrogen economy in the soil as influenced by various crops grown under control conditions, R. C. WRIGHT (*Soil Sci., 10 (1920), No. 4, pp. 249-289, figs. 9*).—Pot experiments conducted by the Bureau of Plant Industry of the U. S. Department of Agriculture are reported, from which it was concluded that cultivation or excessive aeration of a soil causes a loss of total nitrogen. It was found that under certain crops there is an absolute loss of nitrogen in excess of that recovered in the crops, which varies with different crops and different soils and occurs under certain legumes as well as nonlegumes. The nitrogen fixed by certain legumes in their growth was found to be in the crop above ground, and when this was removed the soil was depleted of nitrogen the same as if a nonleguminous crop had been grown and removed.

While it is recognized that these results are not directly applicable to field conditions, it is considered probable that the changes found to occur under experimental conditions indicate relatively similar changes in the nitrogen content of field soils.

Numbers of protozoa in certain Rothamsted soils, L. M. CRUMP (*Jour. Agr. Sci. [England], 10 (1920), No. 2, pp. 182-198, figs. 20*).—This paper, a contribution from the Rothamsted Experimental Station, reports data on the numbers of protozoa in certain Rothamsted soils.

It was found that flagellates, amœbæ, and thecamœbæ are usually present in these soils in the trophic condition and in comparatively large numbers. The protozoan fauna were practically confined to the top 6 in. of the soil. There was a definite inverse relation between the numbers of bacteria and amœbæ. The amœbæ were not influenced by variations in the water content and temperature of the soil or by the rainfall. It was found that the richer the soil is in organic matter the richer it is in protozoa, especially amœbæ and thecamœbæ.

A method for estimating the number of active protozoa in the soil, D. W. CUTLER (*Jour. Agr. Sci. [England], 10 (1920), No. 2, pp. 135-143*).—A method for estimating the number of protoza in the active noncystic state in soil is described, based on studies conducted at the Rothamsted Experimental Station. In this method the total number of protozoa is first found by dilution. A fresh portion of the soil is then treated with 2 per cent hydrochloric acid over night. By this means all active forms are killed. A second count by the dilution method gives the number of cystic protozoa in the soil. From these results the number of active forms can be ascertained.

The importance of Enchytræiden in the formation of humus, G. JEGEN (*Landw. Jahrb. Schweiz, 34 (1920), No. 1, pp. 55-71, figs. 17*).—Experiments are reported which showed that Enchytræiden in soils have a tendency to counteract the injurious influence of nematodes on certain crops, and in addition are of extreme importance in the formation of humus in certain soils, particularly productive meadow soils.

These organisms lived in ordinary garden soils about three weeks without increase and disappeared after the fifth week. In garden soils mixed with silica they disappeared after the third week. In forest soils containing considerable organic matter they thrived until the supply of organic matter was exhausted and then disappeared, as was also the case in garden soils mixed with vegetable matter. They showed a marked and permanent increase in fertile and productive meadow soils.

Examinations of clay, loam, loamy sand, sand, and humus soils showed that the humus soils contained the most Enchytræiden and the clay and loam soils the fewest. Experiments with sand soil, sand soil mixed with vegetable mat-

ter, sandy soils growing grass, and garden soil in which Enchytræiden were added to the first three showed that in the second and third soils the organisms developed and humus formation increased, while in the first soil the organisms died. The fourth soil containing no Enchytræiden remained unchanged. It is concluded to have been proven, experimentally at least, that the addition of Enchytræiden to soils containing vegetable matter starts the process of humus formation.

The effect of certain environmental conditions on the rate of destruction of vanillin by a soil bacterium, W. J. ROBBINS and A. B. MASSEY (*Soil Sci., 10 (1920), No. 3, pp. 237–246, fig. 1*).—Experiments conducted at the Alabama Experiment Station are reported, from which it is believed that the number of species of soil bacteria able to destroy vanillin is limited. Slight concentrations of hydrochloric acid were found to inhibit the action on vanillin of the soil organism studied, while aeration was found to favor the destruction of vanillin.

In solution cultures containing calcium acid phosphate, sodium nitrate, and potassium sulphate, singly and in combination, and inoculated with the organism used, vanillin was destroyed most rapidly in those solutions high in calcium acid phosphate and least rapidly in solutions high in potassium sulphate. The presence of glucose had no marked effect on the rate at which vanillin was destroyed.

Soil fertility [studies at the Umatilla (Oreg.) Reclamation Project Experiment Farm], H. K. DEAN (*U. S. Dept. Agr., Dept. Circ. 110 (1920), pp. 20–22*).—Soil fertility studies of the virgin soils of the project, including crop rotations and treatments with commercial fertilizers, barnyard manure, and green manure crops, are described, showing that for alfalfa greater returns are obtained from manure by the lighter applications. It was also found that corn can not be grown with any degree of success without manuring on the coarse soil of the project.

Fertilizer experiments with wheat on mountain soils, C. B. WILLIAMS, W. F. PATE, E. C. BLAIR, and R. W. COLLETT (*N. C. Dept. Agr. Bul., 41 (1920), No. 10, pp. 2–41*).—The results of experiments to determine the fertilizer requirements of mountain soils of North Carolina growing wheat are reported.

It was found that phosphoric acid is a dominant constituent for increasing yield and profit when growing wheat on Toxaway loam bottom soil. Phosphoric acid combined with potash yielded the largest net returns per acre. Nitrogen combined with potash failed to return enough to pay for the fertilizer application. The use of nitrogen and phosphoric acid gave greater average profit per acre than the use of nitrogen and potash, but not so great as that secured on an average by the use of phosphoric acid and potash. The use of a complete fertilizer gave a net profit which was slightly less than that obtained from the use of a mixture of phosphoric acid and potash. Lime may be used alone on this soil at a small profit and at a much greater profit in conjunction with a complete fertilizer. It is in general recommended that, in the production of wheat on such bottom land soils, at least 600 lbs. of fertilizer per acre be used, containing about 10 per cent of available phosphoric acid and from 1 to 2 per cent of nitrogen.

On Porter's loam upland soil, nitrogen when used alone in normal amounts did not yield a net profit. A net profit was obtained where phosphoric acid and potash were used alone, the greater profit being obtained with phosphoric acid. A net profit was obtained by the use of a mixture containing normal amounts of nitrogen and phosphoric acid and no potash, but not so great as that obtained with phosphoric acid alone. The use of a complete fertilizer did not increase the yield sufficiently to pay for the fertilizer. The use of lime alone

increased the yield and profit, and in combination with a complete fertilizer an additional profit was secured over that with a complete fertilizer alone. The experiments as a whole show that phosphoric acid is the controlling plant food element in this soil for wheat, and that unless more phosphoric acid is applied the use of nitrogen and potash will be made at a loss.

Chemical fertilizers, G. R. P. D'Utra (*Adubos Chimicos. São Paulo: Sec. Agr. Com. e Obras Pub. Estado, São Paulo, 1920, pp. 205*).—This publication deals with the origin, composition, manufacture, and use of chemical fertilizers, with particular reference to agricultural conditions and crops in the State of São Paulo. Information is also given on the selection and purchase of fertilizers on the basis of their composition.

Humogen experiments, S. N. Sil (*Bihar and Orissa Agr. Dept., Expt. Farms and Sci. Sects. Rpts., 1919, p. 19*).—Experiments with humogen on maize to determine its fertilizing action in comparison with that of such readily available organic fertilizers as cattle manure and green manure showed that in a 1-year trial the humogen had very little effect in increasing crop production.

A process for the fixation of atmospheric nitrogen, K. B. McEachron (*Purdue Engin. Rev., No. 15 (1920), pp. 38–43, figs. 3*).—A process for the fixation of atmospheric nitrogen by means of the so-called silent discharge in the presence of water is described, together with results of tests conducted at the engineering experiment station at Purdue University. It was found that the concentrations secured by the silent discharge process are less than one-tenth of that produced by the arc, but the absorption is easier as the product is nitric acid.

The problem of the recovery of ammonia as a by-product in sugar manufacture, A. Rueff (*Ztschr. Zuckerindus. Cechoslovak. Repub., 44 (1920), Nos. 35, pp. 239–243; 36, pp. 249–252; 37, pp. 257–259*).—Different processes for the recovery of by-product ammonia from the sugar industry are briefly described.

Danish experiments with different nitrogenous fertilizers in the years 1914–1918, Jacobsen (*Deut. Landw. Presse, 47 (1920), Nos. 13, pp. 95, 96; 16, pp. 121, 122; 17, pp. 130, 131, figs. 2*).—Comparative tests of Chilean, Norwegian, and ammonium nitrates, ammonium sulphate, and lime nitrogen from German, Swedish, and Norwegian sources are reported, using barley, oats, orchard grass, beets, and potatoes as crops. In addition, mixtures of Chilean nitrate with ammonium sulphate and with lime nitrogen were also tested. In the four years 276 tests were conducted.

It was found that Chilean and Norwegian nitrates gave the best results, especially with barley and oats, the results being about equal. Ammonium nitrate was second in effectiveness, followed closely in their order by the ammonium sulphate and lime nitrogen.

The effectiveness of the different fertilizers varied with the kind of soil and its reaction. The residual effect of all the fertilizers was generally small. The fertilizers exerted a slightly depressing influence on the dry matter content of beets, which was less for lime nitrogen than for Chilean nitrate. The dry matter content of potatoes was more depressed by lime nitrogen than by Chilean nitrate, however. Ammonium nitrate gave better results when broadcast in early spring before planting than at the time of planting. The opposite was true with Chilean nitrate. The mixtures of Chilean nitrate with ammonium sulphate and with lime nitrogen gave results equal to the average of those given by the individual fertilizers in each mixture.

Soils, C. S. Taylor (*Bihar and Orissa Agr. Dept., Expt. Farms and Sci. Sects. Rpts., 1919, pp. 1–3*).—Experiments on the effect of phosphatic fertilizers with and without green manure on poor rice soils showed that the phosphates

by themselves had no influence on the ultimate crop, while the more active phosphates in combination with green manure had a marked effect on the crop when applied at the right time. It was found to be essential in such poor soil to manure with phosphoric acid before sowing the green manure. Apatite had no effect greater than the assumed limits of experimental error.

The potash deposits of Alsace, H. S. GALE (*U. S. Geol. Survey Bul. 715–B (1920), pp. III+17–55, pls. 2, figs. 2*).—This report of a survey of the Alsatian potash industry deals with the geology, location, extent, output, and technology of the deposits and describes the different mines somewhat in detail.

The area of the lower main potash-bearing field is about 65 square miles and of the upper and thinner bed about 33 square miles. For commercial purposes it is considered fair to estimate the average quality of the output over the entire field at about 18 per cent potash. It is estimated that the potash reserve in this field is somewhat more than 300,000,000 tons.

A bibliography is appended.

The relation of lime to agriculture, L. B. BROUGHTON (*Md. Agr. Col. Ext. Bul. 2, rev. (1920), pp. [1]+20, figs. 3*).—This is a revision of this bulletin (E. S. R., 37, p. 218), which furnishes in condensed form information concerning the general use of lime and the source and character of the different forms of lime that are available.

The use of sulphur on soils, M. M. MCCOOL (*Michigan Sta. Quart. Bul., 3 (1920), No. 1, pp. 26–28*).—Experimental work on the subject at various experiment stations is reviewed, and experiments are briefly reported which would indicate that the present knowledge of the subject in Michigan does not warrant the unconditional recommendation of the use of sulphur carriers chiefly to add sulphur to the soils. It is noted that raw sulphur added to a number of peat and muck soils greatly increased the amount of soluble matter in several cases. A warning is sounded, however, that the use of raw sulphur will cause the loss of lime in the drainage waters and an increase in soil acidity.

Can sulphur be considered a fertilizer? H. G. SÖDERBAUM (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 189 (1919), pp. 9; also in K. Landtbr. Akad. Handl. och Tidskr., 58 (1919), No. 6, pp. 357–363*).—Cropping experiments on loam soil with oats to determine the fertilizing value of sulphur when added in the form of finely pulverized brimstone are reported.

The sulphur was added at rates of 1, 2, and 3 gm. per 24 kg. of soil. The difference in the crops obtained from the soils with and without sulphur was so small as to be within the limitation of probable error. It is concluded that the general use of sulphur as a fertilizer can not be recommended.

Some observations upon the effect of borax in fertilizers, W. J. MORSE (*Maine Sta. Bul. 288 (1920), pp. 89–120, pls. 2, figs. 10*).—Attention is drawn to the injury to potato crops in Maine during the season of 1919 where commercial fertilizers were used. Field studies covering a wide range of conditions showed that these losses were mainly confined to fields where certain brands of fertilizers were applied and were associated with the potash used in the manufacture of these fertilizers. Analyses of samples of the fertilizers used showed the presence of boron in appreciable amounts. No definite cases of similar injury to crops were observed where it could be shown that fertilizers free from borax and carrying approximately similar amounts of nitrogen, phosphoric acid, and potash were used.

Pot culture experiments with potatoes, beans, oats, wheat, and buckwheat to determine the influence of fertilizers containing borax were conducted. Samples of six different lots of fertilizer sold in the State in 1919 were applied to potatoes in amounts corresponding to from 0 to 38.6 lbs. of anhydrous borax

per acre, the most extensive trials being conducted with applications at the rate of 17.6 lbs. per acre.

The results of the greenhouse experiments were found to confirm those of the field observations to a large extent. No potato plants receiving fertilizers containing borax escaped injury in some form or other. In general, the amount of injury varied with the amount of fertilizer used, although the results were not uniform in this respect. Except where the largest amount of borax was applied, the type of injury in the greenhouse differed in some important respects from that observed in the field. Killing of the tips and margins of the leaves was characteristic of the injury to greenhouse potato plants. Applications of anhydrous borax at the rate of 17.6 lbs. per acre produced the most severe leaf injury. Where the fertilizer was mixed with the upper 6 in. of soil in the pot or with the 3 in. of soil below the seed piece and the plants heavily watered, the larger applications of boron caused greater root injury, more stunting of the plants, and less tip and marginal injury to the leaves.

An application of fertilizer in the drill equivalent to 4.4 lbs. of anhydrous borax per acre caused severe injury to beans, while broadcasting the same fertilizer, applying the equivalent of 8.8 lbs. per acre, caused no apparent injury to oats, wheat, and buckwheat.

Mineral resources of the United States in 1919, compiled by M. B. CLARK (*U. S. Geol. Survey, Prelim. Summary Min. Resources U. S. 1919, pp. 128, fig. 1*).—This is the second annual preliminary summary of the country's mineral production, and includes, in addition to an introduction by G. F. Loughlin and other matters, sections on potash, phosphate rock, peat, marl, lime, and gypsum.

Analyses of fertilizers—spring season, 1920, J. K. PLUMMER, JR. (*N. C. Dept. Agr. Bul. 41 (1920), No. 12, Sup., pp. 9*).—This publication contains the results of actual and guarantied analyses and valuations of 141 samples of fertilizers and fertilizer materials collected for inspection in North Carolina during the spring season of 1920.

Fertilizer report, J. W. KELLOGG (*Penn. Dept. Agr. Bul. 333 (1920), pp. 93*).—This bulletin reports actual and guarantied analyses of 1,105 samples of fertilizers and fertilizer materials, representing 625 different registered brands, collected for inspection in Pennsylvania from January 1 to July 31, 1919.

Analyses of commercial fertilizers, R. N. BRACKETT ET AL. (*South Carolina Sta. Bul. 203 (1920), pp. 72*).—This bulletin reports the results of actual and guarantied anaylses and valuations of 1,658 samples of fertilizers and fertilizer materials collected for inspection in South Carolina during the season of 1919–20.

AGRICULTURAL BOTANY.

Botany of the living plant, F. O. BOWER (*London: Macmillan & Co., Ltd., 1919, pp. X+580, pl. 1, figs. 461*).—This book, though in a measure adapted to the annual course of elementary lectures on botany as given in Glasgow University, is not intended to conform to any schedule of work nor any examination, the object being to present in simple terms a conception of the plant as a living, growing, self-nourishing, and self-adapting organism.

A plan for cooperative research on the salt requirements of representative agricultural plants, edited by B. E. LIVINGSTON (*Baltimore: Div. Biol. and Agr. of Natl. Research Council, 1919, 2. ed., pp. 54*).—This is a second edition of the plan, noted editorially (E. S. R., 39, p. 603).

During the war period the Division of Agriculture, Botany, and Zoology of the National Research Council established a special committee to attempt the organization of a nation-wide cooperation among the research scientists interested in plant nutrition. The project is being continued (E. S. R., 42, p. 97),

the purpose being to hasten the acquisition of definite knowledge regarding the salt requirements of a few representative agricultural plants.

While each cooperator will be free to interpret and publish his results as he may see fit, the committee hopes to be able to bring together as the work progresses all the contributions, so as to build up rapidly a rather complete statement of salt requirements of each plant that is included in the scheme. It is expected that the correlated system of physiological knowledge to result from this cooperation will place in the hands of agronomists and agricultural chemists many valuable facts and principles upon which, with further experimentation in the field, may be built up a greatly improved system of fertilizer practice and crop rotation. The present project, therefore, is fundamental to the rational advance of agricultural science and practice. This project itself contemplates only physiological studies carried on with water and sand cultures, thus avoiding many of the complications introduced when agricultural soils are involved.

Since the problem for any single plant is so complicated and the amount of logically planned and carefully carried-out experimentation required is so great, attention at the start is to be restricted to two plants, Marquis spring wheat and soy beans. The seed and salts are to be supplied by the committee, and standardized methods are to be employed, as outlined. Citations to the literature are given in this connection.

A thermo-electrical method for the determination of leaf temperature, E. B. Shreve (*Plant World, 22 (1919), No. 4, pp. 100–104, figs. 2*).—The author has obtained successful results in determining the surface temperature of plant leaves by means of a thermo-electrical method which avoids wounding the plants as well as the temperature complications consequent on wounding. The apparatus and its use are briefly discussed.

The rôle of temperature in the determination of the transpiring power of leaves by hygrometric paper, E. B. Shreve (*Plant World, 22 (1919), No. 6, pp. 172–180, fig. 1*).—This paper deals with the part played by the temperature of the slip in the calculations which must be performed to determine the index of transpiring power.

In the determination of the index of transpiring power by tripartite cobalt slips no considerable error is introduced into the calculations by using the temperature of the air immediately surrounding the leaf instead of the temperature of the slip itself. Similarly, in the standardization of the tripartite cobalt slips over a porous evaporating surface in a small closed room, the temperature of the air near the apparatus may be used.

Correlation of wind flow and temperature with evaporation, C. A. Shull (*Plant World, 22 (1919), No. 7, pp. 210–215, fig. 1*).—The author, having collected data at Lawrence, Kans., during the period 1916–1918, presents the results in tabular and graphic form, noting observed correlations.

Water content and temperature as factors influencing diastase formation in the barley grain, W. E. Pickler (*Plant World, 22 (1919), No. 8, pp. 221–238*).—The author has found that absorption of water by barley grains depends on temperature. The seed coats are impervious to lithium chlorid, and the water absorption rate from a saturated solution of lithium chlorid decreases much more rapidly than from distilled water. Osmotic pressure is much greater in barley grains than in Xanthium seeds. At constant temperatures diastase formation increases with the water content of the grains, but it is much less affected by temperature.

Sunlight and its measurement, H. E. Pulling (*Plant World, 22 (1919), Nos. 6, pp. 151–171, figs. 4; 7, pp. 187–209, fig. 1*).—The author presents in the

first part of this paper a brief nontechnical statement of our present knowledge concerning the distribution and amount of energy in the incoming radiation. The second part outlines the complex subject of the measurement of the sun's radiation.

The relation between growth and rest in plants, G. Klebs (*Biol. Zentbl., 37 (1917), No. 8, pp. 373–415*).—In this work, which is related to that previously noted (E. S. R., 35, p. 431), the author studied the behavior of such plants as *Fagus silvatica, Quercus pedunculata,* two conifers, and *Gnetum gnemon* (from tropical Asia).

Hereditarily established characters include specific structures with all their numerous potentialities. The only new characters that develop are those that do so under the influence, remote or immediate, of the environment.

Annual migrations of nitrogen-free reserve materials in woody plants, E. Antevs (*Arkiv. Bot., 14 (1916), No. 16, pp. 25*).—Studies are detailed as applying to Alnus, Pinus, Picea, *Salix caprea,* and *Prunus padus* in regard to reserves not containing nitrogen.

Changes in fats and starch are closely related to weather changes. The starch maximum was attained during the second half of April, just about as the buds burst. Changes closely corresponding in fat and also in glucose and other constituents were observed, and an intimate connection is inferred. External factors appear to be influential in the transformations occurring during this period.

Recent studies on the carbon nutrition of plants, T. Bokorny (*Biol. Zentbl., 36 (1916), No. 9, pp. 385–403*).—This article, as contrasted with the contribution previously noted (E. S. R., 42, p. 433), deals mainly with the lower forms studied in their nutritive relations with such substances as glycerin, alcohol, and aldehydes.

Chlorophyll content and carbon dioxid assimilation in Alpine and lowland plants, M. Henrici (*Verhandl. Naturf. Gesell. Basel, 30 (1919), pp. 43–136, figs. 7*).—A study of plants which grow equally well in the Alps and in the neighboring lowlands is said to have shown that the leaves of the meadow plants *Anthyllis vulneraria, Bellis perennis, Primula farinosa,* and *Taraxacum officinale* contain much less chlorophyll in elevated regions. Notable exceptions are presented by a few plants, mainly those of snowy dales, as *P. hirsuta, P. viscosa,* and *Ranunculus glacialis.* Both Alpine and lowland specimens of these four plants react in specific ways to marked changes in illumination, but no daily variations were noted. Carbon dioxid assimilation in the Alpine plants begins at higher illumination but lower temperature intensity than does that in lowland plants.

The relative amount of assimilation at the two elevations is a function of temperature and light. Each tends to have a definite light requirement, though local exceptions occurred in the experiments owing to snow reflection and weather influences.

The influence of the pyrrolic nucleus in the formation of chlorophyll, G. Pollacci and B. Oddo (*Atti R. Ist. Bot. Univ. Pavia, 2. ser., 17 (1920), pp. 131–145, figs. 4*).—It is claimed that plants growing in a nutritive medium lacking iron may develop an assimilable pyrrolic product resulting in the formation of chlorophyll. Such formation in the absence of iron has been previously unknown.

Evolution of vascular tissue, M. Lenoir (*Ann. Sci. Nat. Bot., 10. ser., 2 (1920), No. 1–5, pp. 1–123, figs. 91*).—The general conclusions from this work refer principally to phenomena connected with vascular tissues. Particular conclusions refer to Veronica, Cucumis, Cucurbita, and Helianthus.

Jacques Loeb's studies on regeneration in Bryophyllum, K. GOEBEL (*Biol. Zentbl., 36 (1916), No. 5, pp. 193–204, fig. 1*).—This is mainly a discussion of Loeb's contributions as previously noted (E. S. R., 34, p. 730).

Dormancy, or delayed germination of seeds, C. WEST (*Sci. Prog. [London], 15 (1920), No. 57, pp. 34–39*).—This is mainly a review of recent articles on delayed germination, with mention also of other contributions bearing on the subject.

The evidence for a growth-inhibiting substance in the pear tree, H. S. REED and F. F. HALMA (*Plant World, 22 (1919), No. 8, pp. 239–247, figs. 3*).—It is claimed that young vertical shoots of the pear tree tend to remain unbranched because of the dormancy of the lateral buds, amputation of a portion of the shoot being followed by a development of lateral buds situated immediately back of the point of amputation. The manner of growth suggests that a growth inhibiting substance is produced in the apical portion of the shoot and that it travels toward the base, perpetuating a condition of dormancy in the subapical buds. Horizontal pear shoots produce the most vigorous growth from buds near the dorsal line of the shoot, slight growth in those on the ventral line, and intermediate growth in other positions. This behavior is considered to indicate that the growth-inhibiting substance accumulates on the ventral side of shoots, thereby freeing the dorsal buds from destraining factors.

Pollination, W. H. CHANDLER (*Ind. Hort. Soc. Trans., 1918, pp. 111–120, figs. 2*).—A discussion of principles, benefits, and methods of pollination.

An anomaly in the nuclear history of spores, F. MOREAU (*Bul. Trimest. Soc. Mycol. France, 35 (1919), No. 1–2, pp. 98–101, fig. 1*).—Spores of *Endophyllum sempervivi*, normally binuclear at first, show later four or even six nuclei. Interpretations of this and related phenomena are offered.

Sulphur bacteria, M. DÜGGELI (*Neujahrsbl. Naturf. Gesell. Zürich, No. 121 (1920), pp. 43, figs. 14*).—This deals with the production and accumulation in nature of hydrogen sulphid and the relation thereto of the so-called sulphur bacteria. A section deals with denitrifying bacteria. The work concludes with a list of 166 titles bearing on the subject.

Enzyms of yeast, T. BOKORNY (*Biol. Zentbl., 36 (1916), No. 10, pp. 475–493*).—This is a study of enzyms in relation to several substances as acids and bases. Most of the enzyms appear to be predominantly nitrogenous.

Anatomical and biological observations on Lathræa, E. CHEMIN (*Ann. Sci. Nat. Bot., 10. ser., 2 (1920), No. 1–5, pp. 125–272, figs. 91*).—This account (with bibliography and index) deals with a study of *L. clandestina* and *L. squamaria* as regards nutrition and reproduction.

The general conclusion reached is that Lathræa presents a case of adaptation to subterranean life in a plant which has preserved the complex phanerogamic organization in the new environment. It is conceivable that accidental and partial parasitism may have determined and led to adaptation to darkness, and that such adaptation has resulted in complete loss of chlorophyll and establishment of a completely parasitic existence.

Native vegetation as a criterion of site, C. F. KORSTIAN (*Plant World, 22 (1919), No. 9, pp. 253–261*).—The author urges that in the determination of site no single criterion should be adopted to the positive exclusion of other feasible criteria, as it may be found that one may serve as an excellent check on the other or may even more closely indicate the true potentiality of a given site quality.

Ecologic diversity and generic coefficients, J. DUFRENOY (*Bul. Trimest. Soc. Mycol. France, 35 (1919), No. 1–2, pp. 27–46*).—Studies indicated are said to confirm the view that regions of slight ecological diversity show greater generic coefficients as regards both cryptogamic parasites and phanerogams.

A comparison of the vegetational features of two desert mountain ranges, F. Shreve (*Plant World, 22 (1919), No. 10, pp. 291–307, figs. 7*).—A comparison is made of the vegetational and floristic features of the Pinaleno and Santa Catalina Mountains, the results of which are detailed.

Some records of the seasonal flora of arable land under cultivation, L. F. and R. W. Newman (*Jour. Ecology, 6 (1918), No. 3–4, pp. 178–188*).—Having for several years kept accurate records of the numerical and seasonal occurrence of the weeds of arable land under ordinary culture, the authors present in tabular form with discussion the number and species of weeds found on six areas in fields under different crops as taken at intervals throughout the year in a farm on the borders of Hertfordshire and Essex. The tables show among other things that certain species suddenly appear in large numbers on a field, particularly after disturbance of the soil by ordinary agricultural operations. A species may establish itself throughout the season and show a series of individuals all growing to maturity, or it may suddenly die away and disappear. The causes of this behavior have not been determined.

Environmental changes and their effect upon boll shedding in cotton, F. E. Lloyd (*Ann. N. Y. Acad. Sci., 29 (1920), pp. 131, pl. 1, figs. 25*).—Work done by the author in Alabama during 1911–12 to articulate with work done in 1905–1907 (but not published except as embodied in this report) and continued in North Carolina during the summer of 1913 is reported in considerable detail. The purpose of this study was, if possible, to resolve the complex of causes which may lead to the shedding of cotton squares, blooms, and bolls.

It was found that the rates of shedding are on the whole gradually increased throughout the season until limited by the growth of the plants; the shedding during the earlier period being numerically less than the flowering. Day to day variations are usually explainable by rain in the day time (causing incomplete fertilization) and by variations in environmental conditions. These responses appear to be positive to increased insolation and lower moisture content of the superficial soil layers, or negative to rainfall ameliorating surface soil conditions (and perhaps attendant above ground conditions). The effects of these variations appear to be additive to another condition (not measured in this work) namely, the moisture content of the deeper soil layers, reached only by the deeper root system and probably receding as the season advances too fast to continue fully available to the advancing root system, which may become nearly or quite static about this time.

It is possible that cotton races differ as regards adjustability to moisture variations in the deeper soil layers, so that the period of approximate balance of shedding and flowering may be regarded as one of delicate equilibrium of the plant with its environment. At this period (occurring about August 14–26 in 1907) variations in temperature, superficial soil moisture, and their accompaniments appear to produce what is here termed a physiological hysteria, expressed in wilder fluctuations in the shedding rates. After such period, conditions call out more marked shedding responses, the plant now being less effectively in correspondence with its environment. This is not a time of increased growth above or below the soil surface. The deeper roots are primarily involved in this connection, as the surface soil does not conserve its moisture throughout the summer. The effect of conditions during this later period were much more marked in 1907 than in 1906, owing to the lateness of the spring in the latter year and to the subjection of the freely fruiting plants to the severe conditions of the latter season, in which the older bolls were shed in larger numbers, reducing the total product for that year.

Among the more general conclusions reached it is stated that abscission of cotton flower buds and bolls is brought about by digestion of the middle lamella

and adjacent layers of the cellulose wall, the extent of which is related to the age of the cells involved. Abscission is preceded, according to the age of the cast-off part, by more or less growth of the cells of the abscission zone, and usually, by cell division.

More or less distortion may occur, owing to the peculiar morphology of the fruiting internode and resulting disparity of growth as between the concrescent pedicel and stem elements. Abscission tissues may even extend more or less longitudinally along the fruiting internode, in which case a distinctly pathological behavior involving extensive histolysis may occur. Injury response period for squares varies from 36 hours to 10 days, the maximum numbers falling on the second day and the great majority being shed within 5 days. Abscission is inhibited during anthesis, open flowers being seldom shed. The injury response period of bolls varies from 24 hours to 6 days, small bolls being shed in 24 hours with a maximum of about 48 hours after injury. Abscission is hastened about 12 hours if the injury is inflicted in the afternoon rather than in the forenoon. This is thought to be due to the more prompt reaction of turgid tissues. Shedding after boll weevil injury occurs in 1 to 20 days, the maximum falling about the eighth day. Rain causing destruction of bolls produces a high degree of shedding of bolls if it falls in the late forenoon. Bolls doomed to shed show inferior growth rates. Shedding under field conditions in Alabama is generally attributable to rain and to soil water conditions. A probable factor (more effective in boll shedding) is competition for water.

The malvaceous plants of Texas, H. C. HANSON (*Texas Sta. Circ. 22 (1920), pp. 18*).—A study was made under the auspices of the Federal Horticultural Board, U. S. Department of Agriculture, of the wild and cultivated malvaceous plants of Texas in order to determine whether they could possibly serve as host plants for the pink bollworm. The author gives a list and description of the plants known to occur within the State.

On variation in Tartary buckwheat, Fagopyrum tataricum, J. ZINN (*Genetics, 4 (1919), No. 6, pp. 534–586, figs. 11; abs. in Maine Sta. Bul. 284 (1919), pp. 296–298*).—A report is given of a study of an ever-sporting race of *F. tataricum* discovered by the author. This race has been isolated and its characteristics studied for five generations under varying conditions of environment. The variations observed occur in the gynœcium, the perigone, and the vegetative organs of this race. The variations in the gynœcium are characterized by the production of supernumerary carpels. The frequency of the normal, five-parted perigone decreases as the number of carpels per pistil increases. The teratological development of the vegetative organs in the form of more or less developed fasciation was reproduced under favorable conditions of environment, in 50 per cent of the offspring. All the descendants of the ever-sporting race were found to reproduce the ever-sporting type of the mother plant, regardless of whether they originated from normal or abnormal fruits of the parent.

Heribert-Nilsson's objections to the views of De Vries in regard to mutation, H. KRANICHFELD (*Biol. Zentbl., 37 (1917), No. 2, pp. 61–98*).—This is a discussion of the studies and conclusions previously noted (E. S. R., 39, p. 825).

An improved colorimeter for color inheritance study, H. F. ROBERTS (*Plant World, 22 (1919), No. 9, pp. 262–269, figs. 5*).—Descriptive discussion is given of an apparatus which the author has found suitable to the purpose of quantitative measurement of color value in flowers in the study of color inheritance. Clear and definite results in studying the color values of segregates

were obtained with Pelargonium. By supplementing these records with Lumière color photographs a practically perfect series of inheritance records may be obtained.

FIELD CROPS.

[Report of field crops work at the Umatilla (Oreg.) Reclamation Project Experiment Farm in 1918 and 1919], H. K. Dean (*U. S. Dept. Agr., Dept. Circ. 110 (1920), pp. 5, 10, 11, 12–17, 23, figs. 4*).—This describes the continuation of work along the same general lines as previously noted (E. S. R., 40, p. 431).

Approximately three-fourths of the irrigated acreage on the project is said to have been devoted to alfalfa hay during recent years. In reviewing the development of the project, it is noted that while the cropped area increased 5,689 acres, or 205 per cent, from 1911 to 1919, the alfalfa acreage increased 287 per cent. In 1919 a total of 25,836 tons of hay valued at $483,133 was produced. The average acre yield for the nine year period, 3.7 tons, is considered low, and appropriate cultural, fertilizer, and irrigation methods for its increase are suggested.

Weed pests threatening to become troublesome in alfalfa and cultivated fields on the project include *Bromus tectorum*, *Setaria viridis*, *Hordeum jubatum*, and *Echinochloa crus-galli*. Harrowing, cultivating, and cutting before seed is set are emphasized as important measures in the control and eradication of these weeds.

Mammoth Russian sunflowers, with 28.4 tons of forage per acre, outyielded 46 corn varieties in preliminary tests of silage crops. Hopi corn, a southwestern Indian variety, produced 10.8 tons of forage in 1918 and 8.93 tons in 1919 as compared with 5.78 tons, the average yield for all varieties. Besides Hopi, the tests show Bloody Butcher, Colorado Giant Fodder, Sullivan White Dent, and Dependable Yellow Dent to be promising for silage purposes.

Results of 5 years' experiments on the frequency and depth of irrigation of alfalfa are held to indicate that on a medium sandy soil 4 acre-inches of water applied at biweekly intervals have given the largest net returns. When water was applied each week, the increased yields did not seem to justify the additional labor cost and water charge.

Baltic was the highest in row tests of five alfalfa varieties, yielding about 25 per cent more than the average. Although white sweet clover equaled alfalfa in 1918, its yield was considerably lower the following year.

Crops on the experimental fields, J. B. Harrison and R. Ward (*Jour. Bd. Agr. Brit. Guiana, 13 (1920), No. 3, pp. 130–149*).—Variety tests, hybridization and selection studies, and fertilizer experiments with sugar cane, and variety and irrigation tests with rice are reported in continuation of similar work already noted (E. S. R., 41, p. 528).

Tabulated data are presented showing the areas devoted to the principal sugar cane varieties on numerous plantations throughout the colony during the crops of 1916, 1917, 1918, and 1919, and average acre yields of sugar from the 1918 crop.

Leading cane varieties in 1918 tests included D367, D248, D118, and D181, with respective yields of 30.8, 27.8, 25.3, and 27 tons of cane per acre, and 3.47, 3.17, 2.97, and 2.97 tons, respectively, of indicated sugar per acre. The average yield of 13 varieties of sugar cane receiving no nitrogen, and applications of sulphate of ammonia at the rate of 40 and 60 lbs. of nitrogen per acre amounted to 14.5, 26.6, and 31.2 tons of cane per acre, respectively, with 1.63, 3.18, and 3.55 tons of indicated sugar. A comparison of seedlings from hybrid, selfed, and uncontrolled parentage confirmed previous results indicating that the

method of raising seedlings in considerable numbers from canes of high vegetative vigor, and taking advantage of the wide variation in saccharin content of the sugar canes which appears to be one of the more fixed characteristics of a seedling, was of equal, if not greater, value than either raising canes of selfed parentage, or hybrids from parent canes of well-marked saccharin strength.

[Field crops in Cyprus], W. BEVAN (*Bul. Imp. Inst.* [*London*], *17* (*1919*), *Nos. 3, pp. 329–336, 354–357, pl. 1; 4, pp. 499–502, 514–521, 522, 523, 529–534*).—Cultural methods and field practices followed in the growing of cereals, legumes, sorghums, forage, fiber, and root crops, and tobacco on the island of Cyprus are described, and data on annual production included.

[Report of field crops work in Mysore, 1917–18], H. V. KRISHNAYYA (*Mysore Dept. Agr. Rpt., 1917–18, pp. 2–18, 25–35*).—This reports the progress of variety, fertilizer, and cultural experiments and breeding work with sugar cane, rice, and ragi, and limited variety tests and improvement work with cotton, and notes field tests with indigo, turmeric, peanuts, jola, sunn hemp, and miscellaneous crops.

[Report of field crops work in Mysore, 1918–19], L. C. COLEMAN (*Mysore Dept. Agr. Rpt., 1918–19, pp. 1–23*).—Variety tests and breeding work with sugar cane, ragi, rice and cotton, and fertilizer and cultural experiments with sugar cane, ragi, and rice are described, and field tests with miscellaneous crops noted.

Electroculture, F. J. RAE (*Jour. Dept. Agr. Victoria, 18* (*1920*), *No. 7, pp. 385–394*).—This is a general review of the subject, the author discussing in brief the different modes of application, including illumination by electric light, conduction of atmospheric electricity from elevated conductors to the soil, burying plates of copper and zinc in the soil and using the soil as an electrolyte, passing a current through the soil from external sources, silent discharge from antennae or overhead network, and electrochemical treatment of seeds.

A variety survey and descriptive key of small grains in Utah, G. STEWART (*Utah Sta. Bul. 174* (*1920*), *pp. 3–35, figs. 11*).—This describes a varietal survey of 2,024 wheat, 627 oats, and 184 barley fields in Utah undertaken preliminary to standardizing the varieties of small grain grown in the State. The varieties studied are classified in accordance with accepted keys, and the more important briefly described. Results of small grain variety tests conducted by the station and various county farm bureaus under both irrigated and dry land conditions are included.

Of 24 wheat varieties found, 60 per cent of the fields grew either Dicklow, Turkey, or New Zealand; another 30 per cent was represented by 6 other varieties, Pacific Bluestem, Marquis, Gold Coin, Kofod, Sevier, and Regenerated Defiance. More than 70 per cent of the oat fields were of the Swedish Select variety, and nearly another 20 per cent were planted with either Green Mountain, Lincoln, or Storm King. The Coast variety of barley was reported on over 67 per cent of the fields, with Club making up 14.7 per cent.

The author concludes that the extensive mixtures that occur among the small grain varieties in Utah occasion great losses to the farmers of the State by reducing the market grades, lowering the yields, and causing wide variation in time of maturity. Results obtained by the Federal grain supervision, showing a high percentage of mixture on Utah wheat, are held to substantiate the conclusions of the survey in indicating the necessity of purifying the varieties.

Böttger's practical guide to the culture of the more important oil plants, J. RICHTER (*Praktische Anleitung zur Kultur der Wichtigsten Ölgewachse. Leipzig: Hans Wehner* [*1916*], *2. ed., rev., pp. 89*).—A small treatise

on the culture of various oil-yielding plants, including the cruciferous plants, sunflowers, Madia, flax, and hemp, the present edition of which has been revised to include recent scientific and practical information on the subject.

Oil seed and fiber plants, WACKER (*Arb. Deut. Landw. Gesell., No. 300 (1919), pp. 102-116*).—The author calls attention to the diminishing production of oil seed and fiber crops in Germany and the increasing dependence of the country on foreign sources for oil and fiber. In urging their more extensive cultivation, he indicates the more profitable varieties of rape, turnip, poppy, mustard, sunflowers, soy beans, flax, and hemp, with suggestions for their culture.

Alfalfa (*U. S. Dept. Agr., Dept. Circ. 126 (1920), pp. 7*).—Brief popular instructions on cultural methods considered best for growing the crop in the New England States and New York are presented, together with descriptions of several commercial varieties suited to the region.

Increase corn yields by fall field selection, J. F. Cox (*Michigan Sta. Quart. Bul., 3 (1920), No. 1, pp. 14-16, fig. 1*).—This presents brief instructions for the selection and preservation of seed corn, and indicates on an outline map the approximate distribution of the leading corn varieties in Michigan.

Growing corn in the Southeastern States, C. H. KYLE (*U. S. Dept. Agr., Farmers' Bul. 1149 (1920), pp. 19, figs. 2*).—This is a revision and extension of Farmers' Bulletin 729, previously noted (E. S. R., 35, p. 639).

Productivity of perennial cotton plants, D. JONES (*Queensland Agr. Jour., 14 (1920), No. 2, pp. 49-52*).—Yields from high-producing perennial plants are noted, and the productivity of upland and Egyptian types are contrasted.

The author states that farmers have grown cotton in Queensland for the past 40 years, relying on its perennial merit. On the coastal areas north of Brisbane, Egyptian perennials are often spaced 12 ft. apart and the intervening spaces and rows planted with an earlier maturing upland variety. Since at least a year or 18 months are required for the Egyptian to come into profitable bearing, and the best yields are obtained from the fourth year onward, the planter gains the advantage of an early crop which is furnished in 5 months from the upland variety. After 2 or 3 years the upland will have outlived its utility and can be cut out, leaving the field to the Egyptian plants.

Commercial parasitism in the cotton industry, O. F. COOK (*Nature [London], 105 (1920), No. 2644, pp. 548, 549*).—In this article, a contribution from the Bureau of Plant Industry of the U. S. Department of Agriculture, the author deplores the fact that the parasitic tendencies of the present commercial system are not limited to the speculative features that are being restricted by law or to the taking of undue profits, but lead to enormous agricultural and industrial waste through the production and manufacture of inferior fiber passed on to the consumer in weaker and more perishable fabrics. Lack of discrimination in buying from the growers is held to be the weak point in the present system, not to be made good by paying all growers more for their cotton but by paying more for good cotton and less for poor cotton.

Field inspection buying is urged, as the uniformity of the fiber, which is an essential factor of quality and value for textile purposes, can be determined much more readily and definitely while the cotton is still in the field than after it is brought to the gin or passed into the bale. This reform in buying would give the commercial system a positive constructive relation to the industry instead of the present negative, parasitic relation.

Manufacturing and laboratory tests to produce an improved cotton airplane fabric, F. TAYLOR and D. E. EARLE (*U. S. Dept. Agr. Bul. 882 (1920), pp. 48, figs. 24*).—This bulletin reports results of tests made by the Bureau of Markets of this Department in cooperation with the Bureau of Standards and the

Signal Corps for the purpose of improving the quality of the fabric produced under the specifications of the Signal Corps and to determine the cotton most suitable for airplane purposes. The material used in the investigations included American Egyptian cotton of the Pima variety, 1⅝ in. staple; Sea Island cotton of 1$\frac{9}{16}$ in. staple; and Sakellaridis Egyptian cotton of 1$\frac{7}{16}$ in. staple.

The mill tests comprised determination of waste percentages, comparative strength and stress tests of yarns and fabrics, and studies of the effect of varying the twist and weave and of mercerization. Elasticity curves reproduced from those made by the stretch-recording device of the automatic cloth-testing machine graphically illustrate stretch and tests of plain weave cloth of varied construction. Laboratory tests conducted in cooperation with E. H. Hinckley, of the New Bedford Textile School, consisted of studies of the effect of the various contributing agents to mercerization and doping, and the application of these results on a commercial scale. The data secured in the several tests are presented in tabular and diagrammatic form and fully discussed.

No wide differences in the amount of waste discarded by the three varieties of cotton were disclosed. The Pima American Egyptian cotton showed a waste percentage of 29.09; Sea Island, 26.7; and high-grade Sakellaridis Egyptian, 27.07. Sakellaridis Egyptian cotton gave the strongest yarn and cloth, a general average of all of the results showing a superiority of about 12 per cent over the Sea Island and the American Egyptian.

The twist recommended by the Signal Corps specifications for 80's and 3/80's yarns was found to be excessive, the best results being obtained by a combination of twist multiples 3.83 in the singles with 3.63 in the ply. Of the several weaves tested, the plain weave was found to be the most practical.

Piece mercerization was found to be superior to yarn mercerization because it allowed increased quantity and uniformity of production while decreasing its cost. At the same time it conserved labor, material, and transportation facilities, and also tended to reduce and equalize the stretch in the warp and filling without materially changing its strength per unit of weight.

Doping changed the stretch-stress qualities of the cloth in quantity only. Nitrate dope gave the cloth physical properties slightly superior to those given by acetate dope. It was noted that increasing the percentage of dope beyond 117 per cent did not improve the stretch-stress qualities of the cloth.

Tests of cloth made by subjecting it to continual stresses in comparison with the usual method as described in the Signal Corps specifications showed that the former method produced results approximately 30 per cent weaker than the latter.

Potato seed certification in United States and Canada, A. G. Tolaas (*Potato Mag., 2 (1920), No. 11, pp. 18, 20*).—A brief progress report of the seed potato certification committee of the Potato Association of America, with a tabulated summary of potato seed certification work in the United States and Canada.

Waterproofing and mildewproofing of cotton duck, H. P. Holman, B. S. Levine, and T. D. Jarrell (*U. S. Dept. Agr., Farmers' Bul. 1157 (1920), pp. 13, figs. 16*).—This bulletin gives directions for the selection and care of cotton duck or canvas for farm uses and describes simple methods for increasing the durability of the material by the application of waterproofing and mildewproofing mixtures. The formulas for four of these mixtures are given with brief directions for their preparation and application. The cost of the treatment is estimated at from 7 to about 11 cts. a square yard.

What can we learn from the potato culture of the United States? O. Appel (*Arb. Gesell. Förd. Baues u. Verwend. Kartoffeln, No. 17 (1918), pp. 68,*

figs. 22).—The outstanding features of potato culture in this country are reviewed for the edification of the German agriculturist, the author describing climatic factors, varieties, cultural methods, and field practices. Notes on the principal potato diseases and insect pests, storage, and handling are included in addition to tabulated data of production and farm and market prices.

Different methods of propagating potatoes, Derlitzki (*Arb. Gesell. Förd. Baues u. Verwend. Kartoffeln, No. 16 (1918), pp. 23*).—The various methods of potato propagation are discussed from a standpoint of relative efficiency, the value of small seed tubers, various sizes of seed pieces, peelings, sprouts, and the different seed eyes being treated in some detail.

Results of inquiries on the dissemination of the different potato varieties, A. Hecker (*Arb. Gesell. Förd. Baues u. Verwend. Kartoffeln, No. 13 (1917), pp. 55*).—A compilation of data on the extent of culture of the several varieties of potatoes in the German Provinces and Federal States, their use in starch manufacture, drying and distilling, and their improvement by breeding and the introduction of new strains. Notes on relative marketability, disease resistance, and stability of the varieties are included in tabular form.

Potato culture on marshy soil, W. Freckmann (*Arb. Kartoffelbaugesell., No. 20 (1919), pp. 24*).—The fertilizer requirements, manipulation of moor land soils, and approved cultural practices with potatoes on this type of land are discussed in this pamphlet, in addition to the inclusion of comparative yields of leading varieties.

Estimation of potato yields, Opitz (*Arb. Kartoffelbaugesell., No. 19 (1919), pp. 35*).—The author contrasted two methods of estimating the yields of potato fields, and found from a number of trials that the use of a system based on tuber count in a given area showed an average per cent of error of +3.5 per cent as compared with +26.6 per cent with a system based on the weight from like areas. The principles underlying the procedure of estimation of potato yields are fully discussed.

[Experiments with potatoes], H. von Feilitzen (*Svenska Mosskulturför. Tidskr., 34 (1920), No. 3, pp. 199–208, fig. 1*).—The results of a test with 35 of the newer varieties of potatoes conducted from 1914 to 1918, inclusive, are reported. The varieties are classified with reference to maturity, their relative disease resistance in these tests is pointed out, and the yields of tubers and starch by groups and individual varieties and the losses during winter storage, due to shrinkage and decay, are tabulated.

The largest average yield for the five years, 30 tons per hectare (890 bu. per acre) with only 6.8 per cent of small tubers, was obtained from Non Plus Ultra, a cross between Sofie and Imperator, which proved to be also relatively high in starch content and very good in keeping quality. The lowest yielding variety in the tests produced an average of only 15.3 tons per hectare as compared with 22.7 tons for all varieties. Gertrud, ranking third in average yield with 28.6 tons of tubers per hectare, stood first in starch production with 4,705 kg. per hectare (4,187 lbs. per acre).

Study on the culture of the soy bean in Cuba, M. Calvino and E. Babé (*Rev. Agr., Com., y Trab. [Cuba], 3 (1920), No. 4, pp. 124–131, figs. 9*).—This reports germination tests, studies of growth habits and seed, comparative yields, and analyses of a number of soy bean varieties secured from the Office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture and other sources.

Report on the results of qualitative tests of the product obtained from the culture of light yellow tobacco in Tripoli [1915–16], A. Sailer (*Bol. Tec. [R. Ist. Sci. Sper. Tabacco Scafati], 17 (1920), Nos. 1, pp. 116–145; 2, pp.*

186–215).—Studies of the prepared leaf and burning tests of the 1915 and 1916 crops of Samsum, Erzegovina, Porsucian, Haya Solouc, Xanti Yakà, Giava, and Virginia Bright tobacco grown in Tripoli are presented in tabular form, comparisons being noted between the products of topped and normal plants, between the effect of various fertilizers, between the different grades of leaves, and between the different types alone, and in mixtures with each other and with Bulgarian, Greek, Levantine, and Macedonian tobaccos.

Experiments on hybridization with Deli tobacco, J. A. HONING (*Meded. Deli-Proefsta. Medan, 2. ser., No. 10* (*1920*), *pp. 1–41, pls. 4*).—This describes the behavior of the F_1, F_2, and F_3 generations of a number of hybrids between selections of Deli tobacco.

Wheat: Variety and cultural work, C. G. WILLIAMS (*Mo. Bul. Ohio Sta., 5* (*1920*), *No. 7, pp. 195–198, fig. 1*).—Wheat variety tests conducted by this station at 14 points in the State for periods ranging from 2 to 11 years showed Gladden, Trumbull, Ohio 9920, and Portage to rank highest when scored on the basis of yields in the different localities. Spring wheat yields are said to have averaged less than one-half those of winter wheat.

A summary of results obtained in time of seeding tests indicated that the largest yields were secured by planting on September 9 in Mahoning County; September 22 in Miami, Trumbull, and Wayne Counties; September 29 in Cuyahoga and Meigs Counties; and October 7 in Clermont County. The date of seeding for any given year is held to be largely governed by the presence of the Hessian fly. In rate of seeding tests wheat made the highest average net yields when sown at the rate of 7 pk. per acre in Meigs and Montgomery Counties, and 8 pk. per acre in Clermont and Wayne Counties.

Improved strains of Aroostook grown wheats, J. ZINN (*Maine Sta. Doc. 539, 1920, pp. 11*).—This is an abstract edition of Bulletin 285, previously noted (E. S. R., 43, p. 641).

Varietal experiments with spring wheat on the northern Great Plains, J. A. CLARK, J. H. MARTIN, and R. W. SMITH (*U. S. Dept. Agr. Bul. 878* (*1920*), *pp. 47, pls. 3, figs. 2*).—Results of extensive variety tests with spring wheat conducted at 11 substations in the northern half of the Great Plains from 1913 to 1919 inclusive, are reported in detail and summary form. The field experiments were carried on by the Bureau of Plant Industry and the State experiment stations in cooperation and independently, the milling and baking studies since 1918 by the Bureau of Markets, and the nitrogen determinations since 1918 by the Bureau of Chemistry. The principal varieties are classed into groups, and brief descriptions, together with notes on the origin and history, are given of each sort. Since Marquis is the most widely grown variety of spring wheat and has been included in tests at all of the 11 stations each year, the authors have used it as the standard of comparison. In addition to yield data considerable agronomic data are presented showing the number of days from emergence to maturity, height of plants, percentage of stem-rust infection, weight per bushel, percentage of crude protein, yield of flour, and volume of loaf.

Climatic records show that the average annual precipitation at the various stations during the period from 1913 to 1919, inclusive, has ranged between 13 and 19 in. Drought and diseases occurring in several of the years are held to be the causes of premature ripening, low yields, and poor quality of wheat.

Results obtained in the experiments indicate that of the two classes of wheat grown, common wheat, as represented in the tests by hard red spring varieties, is best for bread making. The durum wheats have generally outyielded the common wheats and also have been more resistant to rust and drought. The

better varieties of durum wheat yield a higher percentage of flour than common wheat and are equal or superior in content of crude protein, but have a weak gluten as revealed in a lower volume of loaf.

Marquis is the leading variety of the common wheats. Although first introduced into the United States in 1913, it has become more widely grown than all other varieties of spring wheat. In general, it has been the highest yielding variety and has the highest milling and bread-making value. Although susceptible to rust, its short straw and early maturity sometimes enable it to escape infection.

Power Fife is considered to be better adapted than Marquis in northwestern North Dakota and northeastern Montana, because of larger yields, greater height, and but slightly inferior milling value. Haynes Bluestem has yielded less than the Marquis at all stations, is later, has rusted severely with a consequent low bushel weight, and is slightly inferior to the Fife varieties in milling value. Preston has yielded less than Marquis and rusted more, but has matured nearly as early and has possessed a greater bushel weight. In milling and baking value it is equal to Haynes Bluestem.

It is stated that few new varieties have in any way compared favorably with Marquis wheat. The early maturing Prelude and Pioneer have escaped summer drought in some seasons, and they nearly equal Marquis wheat in milling and baking value. In a limited number of experiments the Kitchener, Ruby, and Kota varieties are thought to show promise of being superior to the Marquis.

Of the two widely grown commercial varieties of durum wheat, Kubanka strains have proved superior to Arnautka in yield, rust resistance, and milling and baking value. Other durum varieties have proved superior to Kubanka in some respects. Peliss has been the highest yielding spring wheat in the western portion of the Great Plains area. Acme and Monad are deemed superior to all other durum wheats except D-5 in rust resistance, and are only slightly inferior to Kubanka in milling and baking value. They have also given higher yields, especially in rust seasons, than most other durum varieties. The D-5 variety is considered the most rust-resistant variety grown, and has yielded only slightly less than Acme and Monad. Its milling and baking value, however, is the poorest of all varieties included in the experiments.

The grain wheats for central western districts, J. E. Syme (*Agr. Gaz. N. S. Wales, 31 (1920), No. 8, pp. 533-538*).—Summarized results of tests of wheat varieties conducted from 1909 to 1919 on farmers' experiment plats in central western districts of New South Wales are presented in tabular form, and the best yielding variety in each district is indicated. Varieties deemed of outstanding value included Federation, Marshall No. 3, a late variety, and Canberra and Hard Federation, both early wheats.

The relation of protein content to variety types in American wheat, H. F. Roberts (*Jour. Agr. Sci. [England], 10 (1920), No. 2, pp. 121-134*).—The author reviews investigations of the U. S. Department of Agriculture and the California, Kansas, Kentucky, Maine, Minnesota, Utah, and Washington Experiment Stations on the relation of protein content of wheat to external factors and to variety type. In summarizing the data surveyed, he states that the primary factors in determining the composition of wheat appear to be climatic, but that varietal characters exist which manifest themselves in higher protein content in certain wheat varieties when grown side by side with others in different situations. It is urged in conclusion that since variability in protein content is a varietal characteristic in wheat, strains varying greatly in this respect should be sought out in breeding for general purposes, as a greater flexibility in the starch-protein ratio indicates a greater climatic adaptability. In breeding for a limited locality wheat with a maximum protein content, with

the least possible variability in this quality as computed in terms of the standard deviation, is to be desired.

A new wheat tester (*Grain Dealers Jour., 45 (1920), No. 2, p. 203, fig. 1*).—This describes an improved weight per bushel tester, the noteworthy feature of which is a beam having white figures on a black ground.

Development of uniform grain inspection, R. T. MILES (*Grain Dealers Jour., 45 (1920), No. 2, pp. 176, 177*).—A brief review of the progress and development of grain inspection and grading in the United States.

Sixth annual report of the Montana grain inspection laboratory, A. ATKINSON and E. W. JAHNKE (*Montana Sta. Bul. 135 (1920), pp. 22, figs. 8*).—This outlines the activities of the laboratory for the year ended June 30, 1919. A total of 3,559 samples of various kinds of seeds were tested for germination and purity and 673 samples of wheat were tested for grade, dockage, moisture, etc., during the period embraced by this report.

Seventh annual report of the Montana grain inspection laboratory, P. V. CARDON, W. O. WHITCOMB, and W. F. DAY (*Montana Sta. Bul. 136 (1920), pp. 32, figs. 4*).—The activities of the laboratory during the year ended June 30, 1920, are reported as heretofore, together with the text of the State grain inspection law. The State grain standards and the rules for sampling and procedure in the grading of grain are set forth in some detail.

Montana grades for grain, W. O. WHITCOMB (*Montana Sta. Circ. 90 (1920), pp. 14*).—This circular defines the State standards for wheat, oats, barley, rye, and flaxseed, and includes the rules and regulations governing the taking of samples of grain for grading at the Montana grain inspection laboratory.

New seed law for Utah (*Grain Dealers Jour., 44 (1920), No. 10, p. 993*).—A summary of the new seed law for Utah effective June 1, 1920.

[Seed inspection in Scotland, 1918–19] (*Scot. Bd. Agr. Rpt., 8 (1919), pp. 51–58*).—The work of the Seed Testing Station at Edinburgh for the period August, 1918, to June, 1919, is reported, and notes on the various cereal, grass, clover, forage, flax, forest tree, and vegetable seeds tested are included. The results of a comparative test, in which flax deseeded by the ordinary ripple, drum ripple, and multiple roller germinated 99, 92, and 84 per cent, respectively, indicated that machinery having a tendency to crush flaxseed may reduce its germinating quality considerably by causing internal breakages.

Seed identification, C. FRUWIRTH (*Die Saatenanerkennung. Berlin: Paul Parey, 1918, pp. V+131, figs. 73*).—This work relates the progress of seed improvement and identification work, outlines methods of inspection of seed crops in the field and in storage, and discusses the relation of seed inspection to the production of pure seed. The author treats in detail the recognition of species and varietal mixtures, weeds, and plant diseases depreciating the value of the seed of specific cereals, legumes, grasses, root crops, and vegetables.

Second annual report of the Idaho Seed Growers' Association, May, 1920 (*Idaho Seed Growers' Assoc., Ann. Rpt. 2 (1920), pp. 40, figs. 3*).—This reports the annual meeting held at Pocatello in January, 1920, and outlines the activities of the association during 1919. The following papers were presented: Seed Growers' Association and Its Relation to Idaho Agriculture, by O. E. Scott; Square Dealing in the Seed Industry, by L. F. Graber; The Small Seed Situation in Idaho, by B. F. Sheehan; The Farmer and the Federal Grain Standards, by G. R. Hyslop; Outlook for Clover and Alfalfa Seed Production and Marketing, by N. C. Helms; and The American Beet Seed Industry, by F. S. Harris.

Fuller's thistle, A. ROLET (*Vie Agr. et Rurale, 9 (1920), No. 34, pp. 117–119, fig. 1*).—This describes the fuller's teasel (*Dipsacus fullonum*), notes the ex-

tent of production in France and other countries, and indicates the soils, fertilizers, and cultural methods best suited to growing the plant.

The hawkweeds, or paintbrushes, A. A. Hansen (*U. S. Dept. Agr., Dept. Circ. 130* (*1920*), *pp. 7, figs. 2*).—The weeds and their manner of growth are illustrated and described, their distribution in the United States indicated, and methods of eradication and precautionary measures outlined.

Eradication of silver fern, J. W. Deem (*New Zeal. Jour. Agr., 20* (*1920*), *No. 6, p. 358*).—Methods for the control and eradication of silver fern (*Pteris scaberula*) are indicated in brief.

HORTICULTURE.

Dusting and spraying experiments of 1918 and 1919, W. C. Dutton (*Michigan Sta. Spec. Bul. 102* (*1920*), *pp. 3–50, figs. 28*).—In continuation of work reported for 1917 (E. S. R., 39, p. 349), detailed results are given of dusting and spraying experiments conducted during the seasons of 1918 and 1919. Comparisons were made with various sulphur-arsenate dust mixtures, lime-sulphur solution, Bordeaux, dry lime sulphur, lead arsenate, calcium arsenate, and magnesium arsenate. These materials were used on apples, cherries, plums, peaches, currants, and potatoes.

The results as a whole indicate that dusting will give satisfactory control of apple scab and chewing insects, when weather conditions are not too favorable for scab development. Dusting was superior to dilute lime-sulphur-lead arsenate solution during the three seasons 1917–1919. The dusting method of application, however, is recommended at this time only as a supplement to spraying since no dusting material has been developed which will completely control scale insects. No recommendation can be made covering aphis control because of the lack of injury on check trees. The dry lime sulphurs and B. T. S. (barium tetrasulphid) have not given satisfactory control of apple scab. Owing to the scarcity of live scales in 1918 and 1919, no experiments were conducted for the control of San José scale.

Lead arsenate is recommended for general use on all kinds of fruits. It has given uniformly better results than any other arsenate. Calcium arsenate has given excellent results when used on potatoes and other similar crops, but was not always satisfactory on fruit trees. Magnesium arsenate caused severe foliage injury on peaches and apples and failed to give satisfactory control of codling moth.

Sulphur dust failed to control shot-hole fungus on English Morello cherries. It also failed to prevent the primary infection of Coniothyrium which developed seriously on trees of this variety. Dilute lime sulphur controlled shot-hole fungus and prevented any development of Coniothyrium. Dusting mixtures composed of sulphur, lead arsenate, and tobacco dust have caused no injury to plum foliage. Dusting is not recommended for the control of peach leaf curl. No definite recommendation is made regarding summer dusting of peaches. The dusting materials have caused no foliage injury and the indications are that dusting will give satisfactory control of peach scab, brown rot, and curculio. Sulphur dust and dilute lime sulphur failed to give satisfactory control of anthracnose on all varieties of currants and caused foliage injury during hot weather. Bordeaux gave almost complete control of anthracnose and caused no foliage injury.

Rules and regulations providing for standard climax baskets for grapes and other fruits and vegetables, and for standard crates, baskets, and other containers for berries, fruits, and vegetables (*Penn. Dept. Agr. Bul.*

348 (1920), pp. 8).—The rules, regulations, and standards here published became effective on and after December 1, 1920.

Home production of vegetable seeds, J. B. KEIL (*Mo. Bul. Ohio Sta., 5 (1920), No. 7, pp. 216–219*).—A discussion of methods of selection, improvement, care, and storage.

Forcing and blanching dasheen shoots, R. A. YOUNG (*U. S. Dept. Agr., Dept. Circ. 125 (1920), pp. 6, figs. 5*).—A reprint of an earlier Bureau of Plant Industry document (E. S. R., 30, p. 442).

Fruit breeding investigations at Long Ashton, B. T. P. BARKER and G. T. SPINKS (*Jour. Pomol., 1 (1920), No. 4, pp. 224–234*).—A brief review of breeding investigations that have been conducted for several years with apples, pears, plums, cherries, currants, gooseberries, raspberries, blackberries, and strawberries, including lists of crosses and selfs that have previously been made and those that were made in 1920.

The raising of fruit trees from seed, M. B. CRANE (*Jour. Pomol., 1 (1920), No. 4, pp. 210–216, pl. 1*).—A contribution from the John Innes Horticultural Institution, Merton, England, giving some of the results obtained in raising various fruits from seed and discussing methods used.

Bud selection: Are we far enough along to show conclusive results? A. D. SHAMEL (*Calif. Assoc. Nurserymen Trans. and Proc., 8–9 (1919), pp. 23–33*).—A contribution from the Bureau of Plant Industry of the U. S. Department of Agriculture. The author reviews the successful results secured in bud selection work with citrus fruits (E. S. R., 43, pp. 439, 440, 542), points out the occurrence of bud sports among deciduous fruits and other plants, and concludes that bud selection from superior performance-record trees is practicable and important.

What rootstocks are we using? W. L. HOWARD (*Calif. Assoc. Nurserymen Trans. and Proc., 8–9 (1919), pp. 34, 35*).—The results are given of a survey of the kinds of stocks used by California nurserymen for almonds, apricots, cherries, peaches, pears, plums, prunes, and walnuts, as compared with a similar survey made three years previously (E. S. R., 40, p. 444).

Manuring fruit trees for continuous crop production, H. E. P. HODSOLL (*Jour. Pomol., 1 (1920), No. 4, pp. 217–223*).—The author describes a system of manuring fruit trees which it is stated has been practiced for some three or four years on mixed plantations with success in producing annual crops on practically every variety of fruit, particularly apples.

A special soluble complete organic manure is applied to the trees in early August, when the current crop is practically developed and will not be apt to draw on this application of plant food. The effect of this dressing is seen in the leaves which remain green and vigorous and obviously working longer than usual. When the leaves fall the trees are seen to be well budded, in spite of the fact that they have borne a heavy crop. This dressing is followed in the winter by another dressing of lasting organic manure such as hoof meal, meat meal, meat and bone meal, etc., thus furnishing a reserve for the trees during the blossoming period.

Minerals have not been used in this work except as an aid to the trees in the spring, when the crop is actually set and when it has been obvious from the appearance of the trees that they are feeling the strain. For this application, from 200 to 400 lbs. of nitrate of potash and soda has given good results. The result of this stimulant is first seen in the leaves immediately surrounding the clusters of fruit. These leaves become darker, stronger, and larger than the general foliage of the tree.

The author points out that manuring under this system must be considerably heavier than is customary, and must be maintained annually in conjunction with adequate spraying and judicious thinning of the crop.

[Orchard management experiments at the Umatilla (Oreg.) Experiment Farm], H. K. DEAN (*U. S. Dept. Agr., Dept. Circ. 110 (1920), pp. 23, 24*).—In the soil management experiment with apples (E. S. R., 40, p. 444), which is completed, the trees on land that had a winter cover crop turned under each year and a cultivated crop grown each summer have made a satisfactory growth and were not materially injured by the cultivated crop. As measured by tree growth, rye as a winter cover crop was less satisfactory than legumes. Trees growing in alfalfa made poor growth. They made fairly good growth when cultivated strips separated the alfalfa from the trees, but the cultivated strips washed and drifted and became lower than the alfalfa strips, making it difficult to irrigate the latter.

An experiment was undertaken to ascertain whether better results would follow from starting a peach orchard on virgin soil rather than on old alfalfa land. The results show a stimulating effect to tree growth in the alfalfa land for the first two years after planting, but a slow growth subsequently. This is attributed to turning under the alfalfa before it had become established long enough to produce the maximum benefit possible. On the virgin soil, vetch cover crops were not materially better than rye cover crops.

Varieties of apples adapted for Ohio culture, P. THAYER, J. B. KEIL, and W. J. GREEN (*Mo. Bul. Ohio Sta., 5 (1920), No. 9, pp. 252–255*).—An extract from Bulletin 290 of the Ohio Experiment Station (E. S. R., 35, p. 40). It discusses in particular the adaptability of the Banana and Ensee apples to Ohio conditions.

Three new varieties of plums, W. J. ALLEN (*Agr. Gaz. N. S. Wales, 31 (1920), No. 10, pp. 744, 745*).—The following varieties of plums under test by the New South Wales Department of Agriculture are described: Higgins Seedling, Wilson Seedling, and Tucker Beauty.

A strawberry bibliography, C. H. PAYNE (*Jour. Pomol., 1 (1920), No. 4, pp. 235–242*).—A compilation of the principal American, English, French, and German works on strawberries.

A complete cranberry fertilizer for savanna bottom, C. S. BECKWITH (*Amer. Cranberry Growers' Assoc. Proc. Ann. Meeting, 50 (1920), pp. 5–7*).—Based on the investigations thus far conducted in the New Jersey Experiment Stations cranberry investigations at Whitesbog (E. S. R., 42, p. 441), the author recommends a formula of 75 lbs. nitrate of soda, 75 lbs. dried blood, 300 lbs. rock phosphate, and 50 lbs. sulphate of potash per acre. Although the general use of fertilizers on muck bottom is not advised, where the vine growth is satisfactory the above mixture has been used with satisfactory results the first year on muck bogs where the vines are too thin to make the crop worth picking.

Study of the influence of various grape stocks on the quality and yield of the crop, H. FAES and F. PORCHET (*Étude de L'Influence de Divers Porte-Greffes sur la Qualité et Quantité de Récolte. Lausanne: Sta. Vit. Lausanne, 1920, pp. 55, figs. 34*).—A contribution from the Lausanne Viticultural Station reporting in detail the results secured during the period 1911–1919 in several experimental vineyards established in different regions of Vaud. Special attention was given to the influence of the stock on the scion as evidenced by the quantity and quality of the product. The Vaudois grapes were cleft-grafted on pure American and on American and French-American hybrid stocks.

Progress report on the Arlington grove experiment, R. S. VAILE (*Calif. Citrogr., 6 (1920), No. 11, pp. 44, 66, 67, figs. 3*).—A contribution from the Cali-

fornia Citrus Experiment Station, which comprises observations on the behavior of a 25- to 30-year old badly run-down navel orange grove in response to various cultural practices systematically applied to different parts of the grove during the past five years.

The author concludes, with reference to fertilizers and tillage, that readily available nitrogenous fertilizers applied in the spring may be expected to give an effect on the crop then setting. Manure will probably fail to give an effect the first season, as will also the surface mulching of the soil. Surface mulching of the soil encourages the rapid development of fiber roots which react with great benefit on the appearance and crop of the tree; but this improvement is followed after a few years by a marked deterioration. When the mulched areas are plowed up there is almost certain to be a period of renewed stimulation.

The use of stable manure plowed under is the only practice that has shown consistent gains throughout the period when tree condition is considered as well as yields. The furrow manure method (E. S. R., 41, p. 837) has not been as satisfactory as broadcasting and plowing under the manure. Summer cover crops with manure have shown no advantage over manured and cultivated plats. Severe pruning, even on trees in poor condition, does not seem to be necessary or desirable.

Contribution to the study of the oil palm, L. TIHON (*Belg. Min. Colon., Renseig., 9 (1920), pp. 37–69*).—A study of different varieties of the oil palm (*Elæis guinéensis*) with reference to their yield in nuts and oil, including a comparative study of methods of extracting palm oil. The enemies of Elæis are also briefly discussed.

The almond in Tunis, L. GUILLOCHON (*Bul. Soc. Hort. Tunisie, 18 (1920), No. 147, pp. 150–152*).—A brief note on the almond industry in Tunis, including descriptions of the varieties grown.

Pruning experiments on young tea, H. R. COOPER (*Indian Tea Assoc., Sci. Dept. Quart. Jour., No. 2 (1920), pp. 44–47*).—A progress report on experiments being conducted at the Tocklai Experiment Station, Assam (E. S. R., 41, p. 242).

Notes on the history of the bearded iris, J. C. WISTER (*Jour. N. Y. Bot. Gard., 21 (1920), No. 250, pp. 181–191*).—A brief sketch of the history and development of the bearded iris both in Europe and in the United States.

Ornamentals adapted to Mississippi, S. W. CROWELL (*Miss. Hort. Soc. Proc., 1920, pp. 59–69*).—A varietal list of several herbaceous perennials, dahlias, gladioli, and roses recommended for planting in Mississippi.

FORESTRY.

Forestry and farm income, W. R. MATTOON (*U. S. Dept. Agr., Farmers' Bul. 1117 (1920), pp. 36, figs. 16*).—A contribution from the Forest Service discussing why farm forestry pays, the extent of farm woodlands and the value of woodland products in the United States, methods of securing good forest growth, improving woods by cutting, estimating and selling timber, fire protection, grazing and insect damage, using timber at home, and planting forest trees. A list of valuable forest publications, including those bearing directly on the subject of forestry for the farm, is given, together with information relative to sources of forest literature in the individual States.

The use of stand graphs in determining the limitation of cut, H. KRAUCH (*Jour. Forestry, 18 (1920), No. 7, pp. 719–722*).—A contribution from the Forest Service, U. S. Department of Agriculture, in which the author illustrates and discusses the application of the stand graph in determining the limitation of a cut as applied to an actual virgin stand of yellow pine in the vicinity of Fort Valley Experiment Station, Flagstaff, Ariz.

Use of aircraft in forestry and logging, E. WILSON (*Canad. Forestry Mag., 16 (1920), No. 10, pp. 439–444, figs. 4*).—An account of forest reconnaissance and protective work done during the year by seaplanes in Central Quebec.

Suggestions for rating risks in forest insurance, W. N. SPARHAWK (*Jour. Forestry, 18 (1920), No. 7, pp. 701–709*).—A contribution from the Forest Service, U. S. Department of Agriculture, in which the author outlines at some length the methods of classifying and grading risks in regular fire insurance, and presents a tentative plan for classifying and rating risks in forest fire insurance.

Forest laws [of Minnesota], W. T. COX (*[St. Paul]: Minn. State Forestry Bd., 1919, pp. 47*).—This pamphlet contains the text of the more recent forest laws enacted in Minnesota.

Forestry at Nehasane Park, R. C. HAWLEY (*Jour. Forestry, 18 (1920), No. 7, pp. 681–692*).—A critical discussion of methods of cutting and silvicultural operations employed at Nehasane Park, a tract of about 36,000 acres in the Adirondack Mountains.

Forest trails and highways of the Mount Hood region (*U. S. Dept. Agr., Dept. Circ. 105 (1920), pp. 32, pls. 2, figs. 19*).—A descriptive account of the trails and highways, including instructions for making trips to points of interest in the Mount Hood region. A short key to the forest trees of the region is appended.

Report on the inspection of forests, game, and fish, A. FORRTS (*Rap. Dept. Int. [Switzerland], Con. Fed., 1919, pp. 24*).—A report on the forest, game, and fish administration and management in the various counties in Switzerland for the year 1919.

The forestry section [of the French Colonial Congress of Agriculture] (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 4, pp. 601–685, fig. 1*).—This comprises the following reports to the French Congress of Colonial Agriculture held May 21–25, 1918, relative to different phases of colonial forestry: The Commerce in Colonial Woods and the Needs of the Mother Country, by Gillett (pp. 605–627); The Utilization of Colonial Woods, by Chauveau (pp. 628–641); The Forest Exploitations of Gabon, by C. Quilliard (pp. 642–667); and The Conservation and the Improvement of the Forests and The Forest Régime in Equatorial French Africa, both by J. Guyon (pp. 668–685).

Afforesting experiment in Morocco, F. MAIN (*Jour. Agr. Prat., n. ser., 32 (1919), No. 27, pp. 548, 549*).—A note on the present condition of plantings of various deciduous and coniferous trees that were set out in the region of Sébou, Morocco, in 1914.

Forest conditions and primitive forest practice in West Persia, E. C. M. RICHARDS (*Jour. Forestry, 18 (1920), No. 7, pp. 710–718*).—A descriptive account of forest conditions, practices, and the principal forest trees in the Province of Azerbaijan, Persia, including suggestions dealing with the development of rational forestry in this region.

The actual status of the forests of Cochin China, COUFFINHAL (*Gouvt. Gén. Indochine, Cong. Agr. Colon., Saigon Ser., Bul. 8 (1918), pp. 30+LIV, pl. 1, figs. 3*).—An account of the forests, forest products, forest activities, and organization in Cochin China. A list of the principal forest species of Cochin China, together with statistics on forest products, revenues, and forest laws are appended.

Uses, strengths, and working stresses of British Columbia timber, T. D. PATTULLO (*Victoria, B. C.: Forest Branch, Dept. Lands [1920], pp. 24, figs. 16*).—This booklet deals briefly with the uses, strengths, and working stresses

of such timbers as Douglas fir, western hemlock, western red cedar, Sitka spruce, western soft pine, and western larch.

Nature and uses of Madras timbers, A. W. Lushington (*Vepery, Madras: S. P. C. K. Press, 1919, rev. and enl., pp. XIX+358*).—The present account of Madras timbers has been completely revised and remodeled from a work issued for the Madras Exhibition in 1917. The timbers are arranged in categories containing similar woods, and critically compared with corresponding European and Philippine timbers.

Note on the artificial raising of bamboos in the Akola division of the Berar Circle, C. P., B. I. Shama Rao (*Indian Forester, 46 (1920), No. 10, pp. 518–525, pl. 1*).—A brief description is given of cultural operations employed in growing bamboos and the results secured.

Hevea rubber in Indo China (*Gouvt. Gén. Indochine, Cong. Agr. Colon., Saigon Ser., Bul. 7 (1918), pp. 48*).—This comprises the following series of papers dealing with different phases of Hevea rubber culture in Indo China: A General Account of Different Phases of Hevea Rubber Culture in Indo China, by A. Chevalier (pp. 3–18); Development and Future of Hevea Rubber Culture, by E. Girard (pp. 19–28); Clean Weeding and Rubber Tree Culture, by A. Hallet (pp. 29–38); Hevea Plantations on the Red Soils in the Northern Part of the Province of Thudaumot, by L. Jacque (pp. 39–43); and A Comparison of the Coagulation of the Hevea Latex with Saccharose, Glucose, and Acetic Acid, by E. Girard and E. Rosé (pp. 45–48).

Note on pyinma, ajhar, or jarul wood (Lagerstrœmia flos-reginæ Retz), R. S. Pearson (*[Indian] Forest Bul. 40 (1920), pp. 19, pls. 2*).—An account of this Indian species with reference to its nomenclature, general distribution, local distribution and habit, natural and artificial reproduction, distinguishing characteristics of the tree, characteristics and properties of the timber, uses, methods of working the forest, evaluation, yield, cost of transportation, and the development of trade for this timber. A mounted specimen of wood accompanies the account.

Utilization of sycamore, W. D. Brush (*U. S. Dept. Agr. Bul. 884 (1920), pp. 24, pls. 4, figs. 3*).—This bulletin discusses the general appearance, properties, and structure of sycamore wood; its supply and demand; its utilization by industries; and lumber and timber values. A classified list of uses reported for sycamore by factories is appended.

DISEASES OF PLANTS.

New or unusual plant injuries and diseases found in Connecticut, 1916–1919, G. P. Clinton (*Connecticut State Sta. Bul. 222 (1920), pp. 397–482, pls. 24*).—Notes are given on diseases and injuries, including abnormal growth, of various economic plants as observed by the author from 1916 to 1919, the various subjects being arranged according to host plants. Accounts are also given of destructive attacks of the dry-rot fungus (*Merulius lacrymans*) and of an unusual growth of mold on unsalted butter.

Among the diseases noted are bacterial fruit spot, bark canker (*Myxosporium corticolum*), downy mildew rot (*Phytophthora cactorum*), heart rots (*Polyporus admirabilis*, *P. galactinus*, and *Fomes igniarius*), malformed twigs and aerial crown gall (*Pseudomonas tumefaciens*), smoke injury, and winter injury cankers of apples; anthracnose (*Glœosporium aridum*) and rust (*Æcidium fraxini*) of ash; anthracnose (*Colletotrichum* sp.) and fasciation (accompanied by a fungus, probably a Fusarium) of asparagus; bacterial wilt of

beans; orange rust of blackberry, dewberry, and raspberry; blackleg (*Phoma lingam*) of cabbage; leaf mold (*Alternaria brassicæ macrospora*), leaf spot (*Cercosporella albo-maculans*), and soft rot (*Bacillus carotovorus*) of Chinese cabbage; root rot (*Pythium debaryanum*) and crinkle of celery; anthracnose (*Colletotrichum graminicolum*), purple fungus (*Monascus purpureus*), root and stalk rot (*Gibberella saubinetii*), root rot (*Phytophthora cactorum*), albinism, and pellucid spots of corn; angular leaf spot (*Bacterium lachrymans*) of cucumber; gray mold (*Botrytis cinerea*) of Douglas fir; blister rust (*Cronartium ribicola*) on various species of Ribes and its alternate host, Pinus; rot (*Pythium hydnosporum*), and lightning, smoke, and winter injury of grapes; chlorosis of hydrangea; various fleshy fungi attacking oaks; rust (*Puccinia porri*), yellow leg (*Fusarium* sp.), bastard blossom, bulblet head, elongated spathe, white ring, etc., of onion; root rots (*Phytophthora cactorum* and *Fusarium* sp.) of peas; die-back (*Valsa leucostoma*) and winter injury of peach; downy mildew rot (*P. cactorum*) and winter injury of pear; European canker (*Dothichiza populea*) of poplars; aerial tubers, black heart, curly dwarf, hollow heart, leaf roll, mosaic, net necrosis, potash hunger, premature sprouting, russeted tubers, spindling sprout, wilt, and prematuring of potatoes; chlorosis of Romaine lettuce; damping off (*Pythium debaryanum*) of spinach; bacterial soft rot (*B. carotovorus*), frost mottling, hail injury, lightning injury, and red root rot of tobacco; white spot of Darwin tulips; and glume blotch (*Septoria* sp.), scab (*G. saubinetti*), and stinking smut (*Tilletia fœtens*) of wheat.

Report of professor of botany [Nova Scotia Agricultural College and Farm], H. W. Smith (*Nova Scotia Agr. Ann. Rpt., 1918, pt. 1, pp. 51–58*).—Wheat loose smut, which caused losses estimated to approximate 15 per cent of the total wheat crop in 1917, is said to be controllable by seed selection or hot water seed treatment. Oat loose smut is controllable with formaldehyde. Stinking smut is spreading, though it is also controllable with formaldehyde.

Loss of grain from rusts is estimated to equal that from all other causes combined. Barberry may be one of the least important of the hosts of wheat rust in this region. Potato mosiac is of commercial importance in this Province. Bean anthracnose experiments have not yielded any valuable deductions. Brief notes are given on other diseases.

Diseases and insect pests of plants [Guadeloupe], J. S. Dash (*Guadeloupe Rap. Sta. Agron., 1 (1918–19), pp. 22–24*).—In addition to mention of a few injurious insects, *Marasmius sacchari* is named as the only disease of sugar cane that is serious in Guadeloupe, though there are said to be others of minor importance.

Report on pests and diseases of cultivated plants in the Rhine Province, 1916 and 1917, G. Voss and G. Lüstner (*Veröffentl. Landw. Kammer Rheinprov., No. 3 (1919), pp. 97*).—This report deals in systematic detail with plant diseases and pests as related during 1916 and 1917 to various economic plants.

A Pythium disease of ginger, tobacco, and papaya, L. S. Subramaniam (*India Dept. Agr. Mem., Bot. Ser., 10 (1919) No. 4, pp. 181–194, pls. 6*).—Studies are reported on a fungus attacking ginger, tobacco, and papaya. It is supposed to be allied closely to the *Pythium gracile* group, though differences are indicated. The parasite as studied is regarded as a new species and is named *P. butleri*. Remedial measures are discussed.

The fungicidal properties of certain spray fluids, II, J. V. Eyre, E. S. Salmon, and L. K. Wormald (*Jour. Agr. Sci. [England], 9 (1919), No. 3, pp. 283–307*).—The work previously noted (E. S. R., 37, p. 47) has been continued along similar lines, and the main results obtained during 1916–1918 are given in the present article. During the first two years a number of ammonium

polysulphid solutions were made according to different methods and the fungicidal value of each determined with a view of ascertaining whether a relationship existed between the polysulphid sulphur content and the fungicidal action of these solutions. During this period evidence was obtained indicating that the death point of the mildew (*Sphærotheca humuli*) varied according to its stage of development.

In 1918, by the selection of suitable material, a method was adopted whereby any two solutions could be very strictly compared with regard to their fungicidal action. Thus it could be determined whether the nature of the polysulphid was of importance.

During 1916 it became evident that the powdery patches on the older leaves of the plant were more easily killed than those on the younger leaves. The explanation offered is that the mildew shows in its different stages of development very different powers of resistance to the same solution, being very hard to kill in the stages just following infection, and comparatively easy to kill in the powdery conidial stage on the older leaves. By the selection of only those patches of mildew in the same stage of development and on young, vigorously growing leaves, it is possible to keep a sufficiently fixed standard by which to measure satisfactorily the fungicidal value of different solutions. Where, however, two solutions have to be compared under as strictly similar biological conditions as possible, it is necessary to use mildew patches in the same stage of development on leaves at the same node.

Conclusive proof has been obtained that with polysulphid solutions neither the total sulphur content nor the sulphid sulphur content gives an index of their fungicidal value. The percentage of polysulphid sulphur in polysulphid solutions appears to be the factor determining their fungicidal value, which does not depend on the nature of the polysulphid present.

Bordeaux mixture an active fungicide; an effective sanitation spray, A. D. SELBY and R. C. THOMAS (*Mo. Bul. Ohio Sta., 5 (1920), No. 7, pp. 220, 221*).—Attention is called to the value of Bordeaux mixture for the control of diseases of potatoes, tomatoes, and other vegetables, and also apple blotch, and as a sanitation spray against apple canker and fruit rot.

On account of the labeling of prepared brands of Bordeaux mixture, considerable confusion and uncertainty is said to have arisen, and the authors wish to call attention to the errors in the labels and advise gardeners and apple growers regarding the preparation of this fungicide. Formulas are given for standard and half-strength Bordeaux mixture.

Oat smuts of Washington, F. D. HEALD (*Wash. State Grain Growers, Shippers, and Millers Assoc. Proc., 13 (1919), pp. 28–34*).—The oat crop in Washington, which is second only to the wheat crop in importance, is affected by both loose smut (*Ustilago avenæ*) and covered smut (*Ustilago levis*). The geographical distribution of these smuts is indicated in tabular form for 16 counties. The percentages for 1918 of infected heads in five counties are tabulated, the maximum infections causing heavy losses.

Time of seeding is an important factor in determining the percentage of infection. Less smut is developed in earlier seedlings, owing to the low germinating temperature for oats as compared with that for smut.

Among varieties of which a tabulation is presented showing varietal percentages yielding to smut infection, Texas Red and Kherson were free and three others ranged between 27 and 30 per cent infected. Almost perfect prevention can be effected by employment, with ordinary care, of the means comprehended in the sprinkling method, the dipping method, and the dry or Haskell method.

Practical advice offered includes rotation and seed treatment if necessary.

A note on the oversummering of wheat rust in Australia, W. L. WATERHOUSE (*Agr. Gaz. N. S. Wales, 31 (1920), No. 3, pp. 165, 166*).—Observations regarded as incomplete are considered to show the importance locally of volunteer wheat as an agency for the spread of rust by means of the uredospores.

Flag smut [in Victoria], C. C. BRITTLEBANK (*Jour. Dept. Agr. Victoria, 18 (1920), No. 4, pp. 240–243, figs. 3*).—Flag smut (*Urocystis tritici*), causing losses in wheat crops ranging from 5 to 70 per cent annually, is regarded as far more injurious to wheat interests than rust in Victoria.

Comparative smut resistance of Washington wheats, E. F. GAINES (*Wash. State Grain Growers, Shippers, and Millers Assoc. Proc., 12 (1918), pp. 21–25*).—Three factors that play important parts in determining the percentage of smut to be found in any given field of wheat are the number of viable smut spores in the immediate vicinity of the seed when planted, the date of planting, and the resistance of the wheat plant itself to the smut fungus. Each of these three factors acts independently of the other two. In comparing the resistance of different wheat varieties to smut it is necessary to have the first two factors as nearly uniform for all varieties as possible. This has been done in every case.

Winter wheat seed blackened with smut spores before planting produced plants showing infection percentages ranging from 27 in Turkey to more than 96 in Hybrid 123. Under such conditions of maximum infection Turkey produced more than twice as much wheat as did any of the nine other varieties tested, and 12.5 times as much as Hybrid 128 (infected to 95.1 per cent).

It is suggested that two distinct causes for smut resistance exist, one being a repellant effect of the outer cells, the other an unfavorable interior retarding development of the fungus after infection. Turkey, Forty Fold, and Red Russian appear to possess both these factors. Others are named as having one or other of these factors for resistance.

Data of field plants tested in duplicate each year, representing a 4-year average, are tabulated regarding the comparative yield, grade, and value of Washington wheats planted under normal conditions including smut infections. Triplet, one of more than 1,000 hybrids tested during seven years, appears promising for the Palouse country and is to be tested in other parts of the State.

Most effective method of controlling smut, F. D. HEALD (*Wash. State Grain Growers, Shippers, and Millers Assoc. Proc., 12 (1918), pp. 26–34, fig. 1*).—Bunt, or stinking smut, is considered the most serious plant disease of the Pacific Northwest, having been present during recent years in nearly all wheat fields of Idaho, Washington, and Oregon in amounts varying from traces only to 40, 60, and even 87 per cent by head count and having caused an annual loss of 4,000,000 bu., or 5 per cent of the total crops, not to mention reduction of grades and thrashing machine explosions and fires due to the presence of smut.

Except in case of spring wheat, seed treatment must be supplemented by other practices in the Pacific Northwest, especially in those portions in which infection is unavoidable owing to wind-blown spores.

Experimental seedings have shown that both early and late plantings either are free from smut or show a low percentage of infection. Beginning with seedings early in August, there is a gradual increase in the percentage of infection, the maximum being reached about two weeks after the maximum spore fall. Following the maximum there is a gradual reduction in the percentage of infection to the end of the growing season.

Smut exhaust fans offer promise as a means of preventing fires in separators, improving the quality of the wheat, and reducing the amount of wind-blown smut.

Wheat smut control, G. L. Zundel (*Wash. State Grain Growers, Shippers, and Millers Assoc. Proc., 13 (1919), pp. 34–39*).—The wheat smut problem in the Pacific Northwest is deemed different from that in any other part of the world, owing to climatic conditions, the large size of the farms, the extensive summer fallow system, and the predominance of wind in normal years.

Percentages (average and highest) are given regarding infection as revealed by a smut survey, 1918, in 18 counties, with a summary of spores taken on traps during that year.

The source of infection of smut in the Pacific Northwest is two-fold, namely, smut spores on the kernel and soil infection from wind-blown smut and from smut heads left on the field. Smut spores on the seed grain are successfully treated by dipping for 10 minutes in a solution of copper sulphate and common salt, 1 lb. each in 5 gal. of water, after which the grain is drained and dipped in lime water, 1 lb. to 10 gal. The soil infections must be prevented by cultural practices as indicated. Accuracy in seed treatment is essential.

Safeguarding next year's wheat, G. H. Coons (*Michigan Sta. Quart. Bul., 3 (1920), No. 1, pp. 9–11*).—For the treatment of wheat for prevention of smut, which is said to be very necessary in Michigan, the author describes the soak and skim, sprinkling, and so-called dry method of treatment with formaldehyde. Where wheat is clean and without smut balls present, the dry method is considered the most satisfactory; for wheat of good grade but somewhat more subject to infection, the sprinkling method is advised; and where wheat is of low grade, that is, considerably infected with smut, the soak and skim method is recommended.

Treatment of winter wheat for stinking smut, P. Ehrenberg (*Fühling's Landw. Ztg., 67 (1918), No. 23–24, pp. 425–432*).—An account is given of an outbreak of stinking smut of winter wheat in south Hanover, Germany, in 1917, and of attempts to combat the disease by means of seed treatment with the preparation Uspulun.

Bad pea situation in Delaware due to disease (*Canner, 48 (1919), No. 24, pp. 34, 36*).—In this communication, giving results of a plant disease survey by the Delaware State College of Agriculture, it is stated that cool, wet weather, with a rainfall of nearly 5 in. in May, 1919, resulted in almost complete failure to the pea crop. Diseases constitute an important factor. One of these is bacterial and is spread rapidly by the green lice after starting as a sick-soil disease, introduced on seeds and spattered on the plants, severe winds and blowing sand being in all probabilty contributing factors. Continuous cropping in peas leads to the perpetuity of the disease. A four-year rotation with sod between the pea crops is suggested.

Mosaic of potato, T. Remy (*Veröffentl. Landw. Kammer Rheinprov., No. 2 (1919), pp. 93–95, pls. 4*).—Observations are detailed regarding the presence and effects during 1917 of potato mosaic, which is said to have been widely distributed, causing considerable loss.

Notes on the "ring disease" of potato, H. H. Mann and S. D. Nagpurkar (*Agr. Jour. India, 14 (1919), No. 3, pp. 388–394*).—The greatest enemy of potato interests is the so-called ring disease, the principal difficulty regarding which has heretofore been the lack of knowledge as to its source and the means and modes of its transmission. This rapid bacterial wilt was serious as far back as 1891. Often 20 to 30 per cent, sometimes 70 to 80 per cent, of the plants in an affected plat die. A characteristic symptom is a brown ring occurring in the vascular tissue of the stem. The attack produces a sudden wilting of the plant.

Studies carried out in 1917–18 confirm previous findings as to the conveyance of potato ring disease from crop to crop through both seed and soil. The dis-

ease is extremely infectious, being carried by the seed and by anything brought into contact therewith, as the knife used to cut up the tubers. The infection does not, however, live in the soil for more than five or six months, hence does not pass to the potato crop of the next year.

Potato wart in the United States, G. R. Lyman (*U. S. Dept. Agr., Dept. Circ. 111 (1920), pp. 3–10, fig. 1*).—An account is given of the activity of this Department and the Pennsylvania Experiment Station in studying the distribution of the potato wart due to *Chrysophlyctis endobiotica*.

As a result of a nation-wide search carried on in 1919, the disease is known to occur at the present time only in one large area in the anthracite mining region of eastern Pennsylvania, in six villages in the bituminous section of western Pennsylvania, and in one mining village and one sawmill hamlet of northern West Virginia.

The behavior of American potato varieties in the presence of the wart, L. O. Kunkel and C. R. Orton (*U. S. Dept. Agr., Dept. Circ. 111 (1920), pp. 10–17, figs. 2*).—The results are given of a comparative test of American varieties of potatoes to determine their resistance or immunity to potato wart. In addition to standard American varieties a number of seedlings which were in process of development by this Department and 29 immune English varieties were grown in gardens which were found to be thoroughly infested with the fungus in the autumn of 1918, 409 field tests being made.

The immune English varieties were found to retain their immunity when planted in Pennsylvania. Of the American varieties, a number of important commercial varieties proved immune and a few of the new seedlings were also found to be not subject to attack. It is thought that the growing of immune varieties in and around infested districts will no doubt help to keep the potato wart disease from spreading.

A new host for the potato wart disease, L. O. Kunkel and C. R. Orton (*U. S. Dept. Agr., Dept. Circ. 111 (1920), pp. 17, 18, fig. 1*).—Since the discovery of the potato wart disease in Europe the fungus has been reported on other host plants, particularly on *Solanum nigrum* and *S. dulcamara*. In 1919 the authors carried on inoculation tests with a number of varieties of tomatoes, some of which were found subject to attack. The warts produced on the tomato were harder and less succulent than those on the potato. The warts on the roots were always small while those on the stem were considerably larger.

Experiments in soil sterilization for the eradication of potato wart (*U. S. Dept. Agr., Dept. Circ. 111 (1920), p. 19*).—A report is given of tests carried on in Pennsylvania during the summer of 1919, including steam sterilization by the inverted-pan method and the effect of hot and cold formaldehyde solutions, for the eradication of potato wart. It was found that exposure to live steam under the inverted pan for 85 minutes with a pressure of 90 lbs. destroyed the wart fungus, so far as could be determined by planting potatoes on treated plats. There is thought to be some evidence to indicate that a combination of formaldehyde solution and steam would be more effective than either treatment alone.

Report on diseases and pests of sugar beet and intercrops in Bohemia, H. Uzel (*Bl. Zuckerrübenbau, 25 (1918), No. 21–22, pp. 175–179*).—This report includes, besides diseases, nematodes and other animal pests affecting sugar beets during the year 1916.

Diseases and pests of sugar beet in Bohemia, 1916 and 1917, H. Uzel (*Bl. Zuckerrübenbau, 25 (1918), No. 23–24, pp. 187–192*).—This report deals principally with conditions and studies during 1917.

A method of selecting L511 cane free of the mosaic disease for planting purposes, C. W. EDGERTON (*Louisiana Stas. Bul. 176 (1920), pp. 3–7, fig. 1*).—Attention is called to the mosaic disease of sugar cane which has become widely spread in Louisiana, occurring not only on cane but also on sorghum, corn, and a number of wild grasses. Varying degrees of resistance have been reported of varieties of cane, and the author describes a method of selection of seed of one variety, which, if followed consistently from year to year, it is believed will almost eliminate the loss with this variety.

The variety L511 is said to show red stripes on the stalks, especially on the lower joints, where the disease is present, but healthy canes never show lines or stripes up and down the joints. Plantings made of selected canes of the disease-free variety in 1919 when examined in 1920 showed but five diseased stalks in an acre, while practically all of the stalks grown from cane that showed red stripes had the disease. An inspection in September showed in one row planted with cuttings that did not show any disease only 48 diseased stalks as against 130 healthy ones. An adjoining row, planted with diseased seed of the same variety, showed all infected stalks.

It is believed that by using this variety, selecting disease-free seed, and where necessary, planting in sufficient amounts to provide cuttings for the main crop, loss due to the mosaic disease will be greatly reduced.

Correlation between size of the fruit and the resistance of the tomato skin to puncture and its relation to infection with Macrosporium tomato, J. ROSENBAUM and C. E. SANDO (*Amer. Jour. Bot., 7 (1920), No. 2, pp. 78–82*).—It is stated that in the development of the tomato fruit the cuticular layer increases in thickness with the age of the fruit, and that there is a definite correlation between age and resistance of the skin to puncture. Infection experiments with *M. tomato* on tomato fruit have shown that the amount of possible infection decreases with the age of the fruit. This may explain, at least partially, the ease with which infection without previous injury is obtained on the young fruit, although it is not claimed to have been shown absolutely that the inhibition of infection is purely mechanical.

Root rot of tobacco, T. HOUSER (*Mo. Bul. Ohio Sta., 5 (1920), No. 8, pp. 232–234*).—The author reports the root rot of tobacco due to *Thielavia basicola* as being an important if not the chief cause of tobacco crop failures in the Miami Valley of Ohio. The symptoms of the disease are described, and it is claimed that temperature and moisture conditions are very important in the survival from season to season of the root rot fungus, both in the field and in plant beds. Hot, dry weather checks the development of the disease, and plants are able to survive and produce satisfactory crops after transplanting if the hot period is followed by plenty of rainfall.

The author suggests that seed beds be sterilized every year, as changing the beds to new soil can not be depended upon.

Common insects and diseases of the apple, W. W. CHASE (*Ga. State Bd. Ent. Bul. 54 (1919), pp. 52, pls. 12, fig. 1*).—In substance and purpose the contents of this bulletin are said to be practically identical with those of Bulletin 38, previously noted (E. S. R., 29, p. 353), although certain modifications and improvements recently worked out are incorporated.

Comparison of dusting and spraying apples in Nova Scotia in 1917, P. A. MURPHY (*Fruit Growers' Assoc. Nova Scotia Ann. Rpt., 54 (1918), pp. 58–71*).—The principal portion of this work was devoted to a comparison of dusts of various strengths and composition with lime sulphur and Bordeaux mixture as related to apple scab, also to burning and drop. The results are

tabulated with discussion. It appears that the apple crop is being reduced year after year by using lime sulphur in too great concentrations, particularly in the last sprays. The weaker strengths now recommended proved as efficient fungicides as the stronger in 1917, and it only remains to be determined whether the spray could not be diluted still further.

The effect of the end-rot fungus on cranberries, N. E. Stevens and F. W. Morse (*Amer. Jour. Bot., 6 (1919), No. 6, pp. 235–241, figs. 3*).—It is stated that certain characteristics of *Fusicoccum putrefaciens* (the cause of end-rot of cranberries) are so distinctive as to make it possible to secure a quantity of berries affected by this fungus and apparently free from all others. The fungus grows readily in all parts of the berry with the apparent exception of the seeds, penetrating both cell walls and protoplasm. A chemical study shows the sugar content of berries rotted by this fungus to be much lower than that of sound fruit. The sugars are thought to be utilized by the fungus.

The dry rot of incense cedar, J. S. Boyce (*U. S. Dept. Agr. Bul. 871 (1920), pp. 58, pls. 3, figs. 3*).—The incense cedar (*Libocedrus decurrens*), a tree of considerable economic importance on the Pacific coast, is said to be inferior because of the uniformly heavy percentage of cull caused by the dry-rot fungus (*Polyporus amarus*). Dry rot, it is claimed, can be eliminated in a large measure from future stands by intensive fire protection, although it can not be entirely controlled on account of unavoidable mechanical injuries caused by pruning, lightning, frost, etc.

For the elimination of this disease the author recommends cutting out of all trees with sporophores and shot-hole cups, all seriously wounded trees, especially those with fire scars, and a cutting rotation which should not exceed 165 years in the intermediate and 210 years in the optimum range of growth.

Is American chestnut developing immunity to the blight? E. R. Hodson (*Jour. Forestry, 18 (1920), No. 7, pp. 693–700*).—A contribution from the Forest Service, U. S. Department of Agriculture, in which the author presents observations of certain investigators indicating that immunity is being developed in American chestnut following a period of struggle. The author points out the desirability of conducting definite systematic observations with the view of supporting this hypothesis. A list of references on resistance to chestnut blight is appended.

The white pine blister rust (*St. Paul, Minn.: State Ent. and Forester, 1919, pp. 4, figs. 11*).—This circular, elaborated by the State entomologist and the State forester in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, and intended for the information of those interested in the protection of white pine against blister rust, deals very briefly with the nature, occurrence, spread, recognition, and control of this disease.

Proceedings of the conference on the spike disease of sandal, edited by L. C. Coleman and K. K. Kannan (*Mysore Dept. Agr., Mycol. Ser., Bul. 4 (1918), pp. 56, pls. 2*).—This publication contains the full report of the proceedings of the first conference on spike disease of sandal, convened at Bangalore, October 4 to 7, 1917. Appendixes contain the full or abridged texts of the papers contributed and a list of the host plants of sandal trees in the spiked areas on the Kollimalai hills. The seven papers are noted below.

Cause of spike disease in sandal (*Santalum album*), R. S. Hole (pp. 17–23).—Spike disease of sandal is believed to be caused primarily by an unbalanced circulation of the sap. The subject is compactly treated herein from the author's standpoint. Other expressions by the author have been noted from other sources (E. S. R., 41, p. 522; 42, p. 544; 43, p. 448).

Note on spike disease, P. M. Lushington (pp. 24–30).—This contains an account of what is supposed to have been the first appearance of spiked sandal in North Coimbatore as far back as 1895. Discussion is also given of the appearance of similar or strongly suggestive phenomena as noted in other plants. Spike is said to be the only known disease causing complete disappearance of sandal. The author agrees in the main with the conclusions reached by Coleman (E. S. R., 38, p. 855).

Extract from the second report on the investigation of spike disease in sandal, T. N. Hearsey (pp. 31–43).—The author is convinced that spike is identical in character, whether occurring in Santalum, Zizyphus, or numerous other plants which are listed. Spike requires a long but unknown period of time to show itself under natural conditions. Two forms of the disease are noted.

Note on the history of sandal spike in Mysore, M. G. Rama Rao (pp. 44–46).—This contains an historical sketch of sandal spike disease with discussions of its three types, the extent of its occurrence, experimental operations in Mysore, means adopted to eradicate the disease and their results, and general observations and suggestions for future work.

Experiments to test the effect of removing lantana on the incidence of spike attacks, H. Tireman (pp. 47, 48).—The results of these experiments are presented in tabular form without conclusions.

Notes on spike disease, C. D. McCarthy (pp. 49, 50).—Fire alone can not cause spike, its action probably being that of a stimulant causing increased circulation of the already poisoned sap. Lantana, if it has any effect on the spread of spike, acts indirectly and remotely, as by its own liability to spread fires. The main, if not the only, region of infection is thought to be above ground. Young plants coming up under lantana sufficiently thick to protect their crowns from aerial infection were free from spike, plants just emerging from their lantana covering showing the disease. Zizyphus (which is very susceptible to spike) and other plants are thought to be originators of this disease, or one closely similar thereto. The infection spreads gradually within a sandal area.

The known occurrence of the trouble in the trees for some time previous to its outward manifestations is taken as evidence of its infectious character. Clearing in front of an infected area (but not clearing within it) checked the advance of the disease.

Field investigation of spike disease in sandal on the Kollimalai hills, M. Rama Rao (pp. 51–54).—The author describes the appearance and development of spike of sandal in successive areas, indicated as occurring in 1912–1916; also the results of an examination of the root systems of spiked trees.

Facts cited are considered to justify the view that the spike disease of sandal is not contagious or infectious, and that it may be endemic or spontaneous.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Preventing fruit tree injury by field mice, W. C. DUTTON (*Michigan Sta. Quart. Bul., 3 (1920), No. 1, pp. 23–26, figs. 2*).—In tests made of paints and washes recommended for use in preventing fruit-tree injury by field mice, the injury was very severe on every lot of trees regardless of the material used. None of these materials can be recommended for use for this purpose, but it is pointed out that a very satisfactory protector can be made from quarter-inch square mesh galvanized wire netting.

Chinese pheasants, H. K. DEAN (*U. S. Dept. Agr., Dept. Circ. 110 (1920), pp. 11, 12*).—It is said that during the last two or three years Chinese pheasants have become common on the Umatilla Reclamation Project in northeastern Oregon, and have caused a material reduction in the yield of corn by digging

up the young plants and eating the seed. Attempts to prevent such injury by treating the planting seed with nicotin sulphate, crude oil, sheep dip, and oil of pine tar proved ineffective. The use on one farm of rags 3 ft. long tied to a string 6 ft. above the ground between two poles 6 ft. apart apparently prevented injury.

Practical handbook of British birds, H. F. WITHERBY ET AL. (*London: Witherby & Co., 1920, vol. 1, pp. VIII+XVI+532, pls. 17, figs. 126*).—This first volume deals with the passerine birds, including keys for their separation. A technical description and a discussion of field characters, breeding habits, food distribution, etc., are given for each form. Six of the plates are in colors. Indexes to the common and scientific names are included.

The gray garden slug [Agriolimax agrestis Linn], with notes on allied forms, A. L. LOVETT and A. B. BLACK (*Oregon Sta. Bul. 170 (1920), pp. 43, pl. 1, figs. 15*).—This is a report of studies of slugs, particularly *A. agrestis*, which are serious pests of truck crops, ornamentals, small fruits, field crops, and greenhouse plants in western Oregon.

"They are especially injurious in early spring and in the autumn during wet weather. Young plants are most seriously injured, although plants in all stages of development are attacked. The three species of slugs of economic concern in Oregon in order of frequency of occurrence are the gray garden slug (*A. agrestis*), the greenhouse slug (*Milax gagates*), and the reticulated slug (*Prophysaon andersoni*). Slugs are likely to be of increasing seriousness as a crop pest due to their great reproductive capacity, their ability to adapt themselves to constantly changing conditions, their tenacious hold on life, and their tendency to associate themselves with man under conditions of intensive agriculture. Development from the egg to the adult probably takes from 90 days to nearly a year, depending upon food and climatic conditions. Slugs are nocturnal in their habits, but are often active in the daytime during cloudy, wet weather. During the day they normally conceal themselves under waste materials and in vegetation or burrow in the soil. Dry, hot weather drives them into temporary seclusion and checks their depredations.

"Under western Oregon conditions repellents and irritants in common use are ineffective against slugs. Many of the poisons in common use as insecticides are of questionable value. Bordeaux mixture, either liquid or dry, is an excellent repellent. Calcium arsenate prepared as a bait is readily devoured and is highly toxic to slugs. A combination of a repellent and poison bait constitutes the most effective control procedure. In our tests Bordeaux mixture 4:4:50 sprayed on the plants combined with the use of a poison bait of calcium arsenate, 1 part to 16 parts chopped lettuce scattered in small heaps over the affected area, gave a high degree of efficiency in plant protection and slug control."

Synopsis of the trematode family Heterophyidæ, with descriptions of a new genus and five new species, B. H. RANSOM (*U. S. Natl. Mus. Proc., 57 (1920), pp. 527–573, figs. 33*).—The members of the family here dealt with are small flukes, parasitic in the intestine of mammals and birds, usually fish eaters. Several of the species are of more or less common occurrence in man, dog, or cat. The genus Cotylophallus is erected for two new species. The species described as new are *Apophallus brevis*, *C.* (n. g.) *venustus*, *C. similis*, *Ascocotyle longa*, and *A. nana*, all intestinal parasites collected at Washington, D. C.

A bibliography of 46 titles is appended.

Collyriclum faba (Bremser), a parasite of song birds: Its structure and life history, G. JEGEN (*Ztschr. Wiss. Zool., 117 [1917], No. 3, pp. 460–553*).—This detailed account of studies of this trematode includes a bibliography of 72 titles.

An annotated bibliography of Porto Rican cane insects, E. G. SMYTH (*Jour. Dept. Agr. Porto Rico, 3 (1919), No. 4, pp. 117–134*).—An annotated bibliography of Porto Rican cane insects, consisting of 136 titles.

List of the insect and mite pests of sugar cane in Porto Rico, E. G. SMYTH (*Jour. Dept. Agr. Porto Rico, 3 (1919), No. 4, pp. 135–150*).—This is an annotated list of 65 forms, which include all the insects that have been found repeatedly feeding upon sugar cane. Of these 26 have not been previously recorded as attacking sugar cane in Porto Rico.

Insects and mottling disease, E. G. SMYTH (*Jour. Dept. Agr. Porto Rico, 3 (1919), No. 4, pp. 83–116*).—Failure to account for the rapid spread of cane mottling disease led to investigations of the possible rôle of insects as agents in its transmission.

The only insect observed in Porto Rico which might be implicated on the south coast at least is said to be the yellow cane thrips (*Frankliniella* sp.). From a large number of inoculation tests six resulted in the transmission of the affection, and three others have shown positive secondary infection (inoculation). These results were obtained from the use of several species of sucking insects, namely, the West Indian cane-fly (*Stenocranus saccharivorus* Westw.), the cane leaf scale (*Pulvinaria iceryi* Guer.), the yellow cane aphis (*Sipha flava* Forbes), and the mealy bug (either *Pseudococcus calceolariæ* Mask. or *P. sacchari* Ckll.).

"No successful inoculations of mottling disease resulted from experimental tests with chewing insects. . . . In view of the small number of successful inoculations secured, as compared with the rather large number of tests made, under conditions which were considered favorable, the question of insect transmission of cane mottling disease can not be looked upon as settled. Factors not visible to the investigator may have entered into the success of the inoculations other than the factor of insect attack."

A tabular summary is given of the status of knowledge of insect-borne diseases of plants and a bibliography of the literature relating to same.

A study of the cost of spraying kale, H. H. ZIMMERLEY and L. B. SMITH (*Virginia Truck Sta. Bul. 30 (1920), pp. 121–134, fig. 1*).—This is a report of studies made of the cost of control work with the more important insect pests of kale in eastern Virginia, including the imported cabbage worm, the cabbage looper, and several species of aphids.

Arsenate of lead powder at the rate of 1.5 lbs. to 50 gal. of water is recommended for the control of the cabbage worms and loopers. Nicotin sulphate 8.75 oz., fish-oil soap 5 lbs., and water 50 gal. are used for the control of the aphids. The outbreaks of the insects usually occur on the plants in the autumn, and most of the spraying will be done at this time.

The data included in this paper are based on spraying operations performed with a two-wheel sprayer, equipped with a gasoline engine and triplex pump, and with booms of a type previously recommended for this crop. In addition to the experimental work done at the station farm, the authors sprayed more than 150 acres of kale in 1919 on local truck farms.

Determinations were made of the speed at which the sprayer was usually hauled, and it was found to vary between 3 and 4 miles an hour. The time in turning at the ends of the rows was also obtained. With a team traveling at the rate of 3.5 miles per hour, and with the rows 20, 24, 30, and 36 in. apart, respectively, it was found (1) that 24 minutes 47 seconds, 20 minutes 43 seconds, 16 minutes 35 seconds, and 18 minutes 5 seconds, respectively, were consumed in mixing the material, filling the tank, and making the application to one acre of kale; (2) that 94.08, 78.6, 62.72, and 52.27 gal., respectively, were necessary to spray one acre; (3) that $1.77, $1.47, $1.18, and $1.14, respectively,

was the cost of spraying one acre with powdered arsenate of lead (used at the rate of 3 lbs. to 100 gal. of water; and (4) that $3.46, $2.89, $2.31, and $2.04, respectively, was the cost of spraying one acre with nicotin sulphate and fish-oil soap solution (nicotin sulphate 8.75 oz., fish-oil soap 5 lbs., water 50 gal.). "It was also found that the saving in the cost of labor and materials by increasing the speed of the team from 3 to 4 miles an hour was $1.02 an acre when the kale was planted in rows 20 in. apart. This amounts to a saving of nearly 25 per cent of the entire cost of application. When the booms recommended for spraying this crop were used there was no loss of effectiveness in the application due to the increased speed of the team."

Fruit grower's handbook of apple and pear insects, A. L. LOVETT and B. B. FULTON (*Oregon Sta. Circ. 22 (1920), pp. 72, figs. 43*).—Information is presented in this pocket handbook under the headings of (1) insects and their work on fruit, (2) insects affecting the buds and leaves, and (3) insects affecting roots, trunk, branches, and twigs. A key, based upon the nature of the injury, by which the pests may be identified is given at the beginning of each part, with brief accounts of the more important species. A brief discussion of insecticides and diagrams showing the relation of the stage in the development of the bud, blossom, and fruit of the apple and pear to time of injury and effective control by use of insecticides are included.

Spray gun v. rod and dust in apple orchard pest control, L. CHILDS (*Oregon Sta. Bul. 171 (1920), pp. 46, figs. 17*).—The data here presented cover the four-year period from 1916 to 1919.

"The dusting method, if properly applied, has been found to control effectively scab and codling moth in the Hood River Valley. Continual wind, which often occurs during the spring, makes it impossible to do effective dusting much of the time. Dust applied under these conditions has been a failure. Present-known dust materials will not effectively control anthracnose, mildew, leaf roller, and the various apple aphids. These numerous limitations in general usage makes dusting under western conditions inadvisable. Dust controls calyx worms. The material is not 'driven' into the calyx cups. Action of gravity is largely responsible. This principle is applicable in the case of materials properly thrown from a spray gun. The fine particles behave in the same manner as they do with dust, and calyx worms are controlled with liquids so applied.

"Comparative tests carried on with spray rods and guns in codling moth control produce results practically identical. Effective control was obtained with each. The spray gun can not be used on every spray outfit. Sprayers of 3½- and 4-h. p. do not possess sufficient reserve power to operate two guns in an entirely satisfactory manner. . . . The spray must be finely broken up and supplied with sufficient force back of it to place the materials in the tops of the trees. There is all the difference in the world in the 'life' of the spray thrown from a 3½-h. p. sprayer and that of one from a 10-h. p. sprayer with the pressure gauges reading approximately the same. There is no overflow in the case of the smaller machine and a liberal one in the case of the larger. On a 3½-h. p. sprayer use only one gun if you desire the right kind of spray. Keep a pressure of at least 250 lbs.

"The cost of applying dust, spray with rods, spray with guns using a 3½-h. p. machine, and with guns using a 10-h. p. machine has been determined. Applications made with the rod are the most expensive. Sprays applied with one gun, using a 3½-h. p. machine, are the least expensive—a few cents less per tree than with the 10-h. p. machine. The great saving of time, however, resulting from the use of the big machine, together with the fact that a perfect spray is produced with no hardship to the machine, makes a big sprayer much more

economical and efficient. The cost of effective spraying in Hood River orchards of 13 and 14 years of age was found to be about $45 an acre, 63 to 70 cts. a tree for the season. The cost is shown to be greater on older trees.

"Orchardists whose reports show irregular average tree usage in the different applications invariably report poor pest contol. Those that show a uniform usage throughout the season have obtained good results. . . . A summary of reports received from a large number of orchardists indicates that many could spend a little more per tree as a spraying charge and reap a decided benefit. An investment of 21 cts. a tree more than already put into the spraying charge would have netted an orchardist $1.04 a tree, much more than enough to pay for the entire season's spraying cost."

Results of experiments with miscellaneous substances against chicken lice and the dog flea, W. S. ABBOTT (*U. S. Dept. Agr. Bul. 888 (1920), pp. 15*).—Tests made of a large number of proprietary insecticides and ingredients entering into their composition at the Vienna, Va., laboratory of the Insecticide Board are reported.

Those made in work with chicken lice have been summarized as follows: "Oil mixtures were effective when lightly sprayed on the birds. When used as dips or when well rubbed into the feathers the treated fowls were killed. Oil emulsions were effective at a dilution not greater than 1:100. Fumigation with oil preparations, the infested bird being placed in a sprayed or painted box for not less than 30 minutes, was effective. The fowls were somewhat injured by this treatment but soon recovered. Oil preparations were of no value against chicken lice when painted or sprayed on the roosts, dropping boards, and the whole interior of the chicken house. Mercurial ointment, applied around or just below the vent of the fowl, was very effective, and vaseline and paraffin were of no value when applied in the same way.

"Forty-five chicken-lice powders containing naphthalene, nicotin, pyrethrum, sulphur, and phenols proved to be effective when the active ingredients were present in the necessary amounts. Powders containing nicotin, naphthalene, and sulphur were effective against chicken lice when added to the dust bath. Lime sulphur added to the drinking water and one powder which was mixed with the food had no effect on the lice. Pyrethrum powder was very effective, and pyrethrum stems of no value against chicken lice. Tobacco powders containing not less than 0.75 to 1 per cent of nicotin are of some value but do not kill all of the lice. About 1.5 per cent is required for the best results. A powder containing 10 per cent of naphthalene was effective against these pests but slightly injured the fowls, and 60 per cent killed the birds when well rubbed in. Naphthalene sprinkled over the backs of fowls at roost proved to be of considerable value against chicken lice. Naphthalene nest eggs were of no value against lice and proved injurious to sitting hens. Thirteen miscellaneous powdered materials were tested and found to be effective and 26 ineffective against chicken lice."

Tests of materials used against the dog flea are summarized as follows: "Pyrethrum powder alone or when it formed not less than 50 per cent of a mixed powder was very effective, but pyrethrum stems were of no value. Pure naphthalene was found to be effective if well rubbed into the hair. Twenty-one lice powders were more or less effective, depending on the amount of active ingredients present and the fineness of the powder. A powder containing 18 per cent of sassafras oil was effective, and powders containing 10 per cent or less or other oils were of no value. Cloves, naphthalene, paradichlorobenzene, and sassafras bark were effective against fleas, and 21 powdered substances were of no value. Tobacco powders containing over 1 per cent of nicotin were of some value against fleas, but a powder containing as high as 4.56 per cent

was not completely effective. The emulsified disinfectants were found to be effective as sprays at the rate of 1 part to 64 parts of water and as washes and dips at 1: 130. Several liquids used as fumigants were found to be effective against fleas."

Thus mercurial ointment, sodium fluorid, sulphur, and pyrethrum are found to be very effective against chicken lice, and pyrethrum powder to be a simple and effective remedy for dog fleas, while finely powdered naphthalene or paradichlorobenzene will be found effective if thoroughly rubbed into the hair.

Thoughts on insects in relation to production of live stock and poultry, F. C. BISHOPP (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 4, pp. 414–422*).

Grasshopper control in the Pacific States, T. D. URBAHNS (*U. S. Dept. Agr., Farmers' Bul. 1140 (1920), pp. 16, figs. 11*).—In this publication the author outlines a program for organized community action; gives descriptions of the common species of grasshoppers occurring in the Pacific States; discusses control on the ranges, in alfalfa fields, in orchards, vineyards, and mountain meadows, and in corn, grain, and bean fields. A detailed account is given of the poisoned-bran mixture and its use.

Pear borer, F. E. BROOKS (*U. S. Dept. Agr. Bul. 887 (1920), pp. 8, pls. 3*).—This is a report of studies of *Ægeria pyri* Harris, a lepidopterous borer long known as the pear borer, but which might better be termed the "apple crotch-borer" since it attacks the apple more extensively than the pear. It occurs over the eastern portion of the United States, and in this region a few of the larvæ can usually be found boring in the bark of almost any old apple tree. They occasionally concentrate in certain trees and there breed in numbers year after year. In the course of the investigations here reported, infested apple orchards in Pennsylvania, West Virginia, and Mississippi were visited, biological studies made, and control methods tested.

This borer is a native insect first described by Harris in 1830. In addition to the pear and apple it is known to attack mountain ash, juneberry, and thorn (*Cratægus* sp.), and has been found in black knots caused by *Plowrightia morbosa* on wild and cultivated cherry. Injury is caused by the larvæ feeding in the bark, the burrows occasionally extending slightly into the sapwood. The larvæ commonly feed in the crotches and in places where there is a rough or broken surfaces caused by the previous feeding of their own kind or by other agencies. Favorite places of attack are around the borders of mechanical wounds in the bark, areas affected by sun scald and winter injury, and around the burrows of other species of borers. Orchards were visited by the author in which it was not unusual to find from 12 to 100 borers working in a single tree.

Oviposition was observed by the author on June 18, 1919, at Quincy, Pa. Larval activity begins early in the spring, active feeding having been observed in West Virginia as early as the last of March. The larvæ feed almost exclusively on the inner bark, although occasionally, where the bark is thin, they will gnaw slightly into the sapwood. Some of the larvæ attain full growth in the fall, and after wintering in their hibernacula, construct cocoons in the spring without further feeding. In West Virginia there are both one-year and two-year larval periods, the duration of this stage depending somewhat upon food conditions and more upon the time in the season when the larva hatched. Apparently, larvæ from early-laid eggs usually transform to adults the following season, having a one-year life cycle, while those from late-laid eggs live in the tree as larvæ over two winters, having a two-year life cycle. Over 100 newly hatched larvæ were collected by the author at various times in the summer and planted in apple trees where their development could be watched. Of

these approximately 25 per cent had a one-year larval period and 75 per cent a two-year larval period.

Pupation takes place within an oblong-ovate cocoon formed of small particles of wood held together by a tough fiber of silk. The cocoon is always hidden beneath a scale of bark or wood fragments. In one case observed the pupal stage covered a period of 23 days. At Love Station, Miss., the earliest record for the emergence of moths was April 26, while at French Creek, W. Va., moths issued from May 11 to August 27.

The burrows of the pear borer are frequently found to be opened and the contents removed by woodpeckers. The larvæ and pupæ are rather extensively attacked by parasites, perhaps 50 per cent of them being destroyed in this way. Seven species of parasites have been reared, namely, *Microbracon* sp., *Phæogenes ater* Cress., *Lissonota* n. sp., *Itoplectis annulipes* (Brullé), *Macrocentrus* n. sp., *Ephialtes æqualis* (Prov.), and *Tetrastichus* sp. Methods of control include removal of the larvæ by means of a sharp knife. The application to the bark of penetrating oily or poisonous liquids kill many borers. As high as 85 per cent of the borers have been killed by kerosene emulsion and the standard emulsified oil sprays, with small quantities of sodium arsenate added, when applied to the bark over the burrows. Nicotin sulphate washes were less effective, but some of the coal-tar products killed over 90 per cent of the borers without perceptible injury to the bark.

Report on the spruce budworm, M. W. Blackman (*Maine Sta. Bul. 284 (1919), pp. 301–303*).—This is an abstract of the report previously noted (E. S. R., 43, p. 852).

Spruce budworm (Tortrix fumiferana Clem.), E. McDaniel (*Michigan Sta. Quart. Bul., 3 (1920), No. 1, pp. 13, 14, figs. 2*).—Attention is called to the discovery, during the latter part of June, of the occurrence of the spruce budworm on Mackinac Island, and the importance of this pest is pointed out.

A new Gracilaria injurious to avocado (Lepid.), A. Busck (*Canad. Ent., 52 (1920), No. 10, p. 239, fig. 1*).—*G. perseæ*, reared by G. F. Moznette from leaves of avocado at Miami, Fla., where it is seriously destructive to the young growth of the plant, is described as new.

Coleophora notes, with description of two new species (Lepid.), C. Heinrich (*Ent. Soc. Wash. Proc., 22 (1920), No. 7, pp. 159–162*).—Notes are presented upon seven species, of which *C. astericola*, reared from *Aster multiflorus* at Boston, Mass., and *C. atlantica*, from larvæ feeding on the leaves of *Prunus serotina* at various points in the eastern United States, are described as new.

Wheat-sowing dates to avoid Hessian fly, T. H. Parks (*Mo. Bul. Ohio Sta., 5 (1920, No. 9, pp. 243–246, figs. 3*).—A survey of the wheat fields in 44 wheat-growing counties of Ohio made during July, 1920, showed that the spring brood of Hessian fly killed or damaged an average of 44 per cent of all wheat straw in the State. In the southern third of the State 22 per cent of all straws were infested, in the central third 42 per cent were infested, while in the northern third 57 per cent of all straws were killed or damaged by this insect. Examinations of pupæ collected during the survey showed that by July 15, 31 per cent had been killed by parasites. Diagrams are given which show the damage caused by Hessian flies in the State in 1920, by counties, and the first dates on which wheat might be sown in 1920 to escape Hessian fly infestation and winterkilling.

The wheat jointworm was present in damaging numbers in only a few counties along the western border. The wheat midge was present in some locations but did not seriously infest the crop.

The horn-fly in Porto Rico, E. G. Smyth (*Rev. Agr. Puerto Rico, 3* (*1919*), *No. 6, pp. 17–28*).—This continuation of the paper previously noted (E. S. R., 42, p. 158) deals with means of control.

Clover stem borer as an alfalfa pest, V. L. Wildermuth and F. H. Gates (*U. S. Dept. Agr. Bul. 889* (*1920*), *pp. 25, pl. 1, figs. 6*).—This is a report of studies made in the southwestern semiarid and irrigated regions and particularly at Tempe, Ariz., in which regions *Languria mozardi* Latr., a native American insect first described in 1807, has become a pest of considerable importance to alfalfa culture.

The young borer injures the alfalfa plant by boring out the center of the stems, leaving a woody fibrous stalk. A complete account is given of its life history and habits as an enemy of alfalfa culture, and of control measures. This beetle occurs throughout practically all of the United States, as well as parts of Canada and northern Mexico, and has a large cosmopolitan list of food plants.

An average of about 60 days is required for the completion of its life cycle, with a minimum of 50 and a maximum of 70 days. The eggs are deposited in the stem of the host plant, and in the case of alfalfa are deposited when it has reached a stage of growth about 8 to 10 in. high. From 2 to 8 days, with an average of 3.8 days, are required for incubation of the eggs. The larvæ, which pass through four molts, require from 24 to 54, with an average of 34.5, days for development, which period is passed feeding within the alfalfa stem. After completing development, cells 8 to 10 in. long are constructed in the stems, within which pupation takes place. From 3 days in July to 18 days in June, with an average of 5.6 days for July and August, are passed in the pupal stage. In the earlier generations the adults feed for a period of 6 to 8 days, and oviposition occurs within the week following. The adults hibernate under rubbish along fence rows, ditch banks, or other waste places. In the southwestern United States there are found to be three distinct generations each year, whereas in the eastern United States there is but one generation. The first generation in the Southwest is passed almost entirely upon yellow sweet clover, and its numbers can be greatly reduced by destroying this weed.

Its predatory enemies include the toad and a number of species of birds. Hymenopterous parasites are its most important natural enemies, three rather important species having been noted by the author. Of these *Habrocytus languriæ* Ashm. is the most important, often as high as 30 per cent of the borer larvæ being parasitized by it. The next most important parasite is *Heterospilus* sp. *Eurytoma* sp. was reared from Languria larvæ and from larvæ of *Habrocytus languriæ*.

"The injury to alfalfa and red clover can be partially eliminated by destroying sweet clover, weeds, and waste alfalfa. The damage also can be reduced greatly by cutting a hay crop before the larvæ have had an opportunity to complete their development. The practicing of proper methods of crop rotation as well as cleanliness of farming, such as burning rubbish, etc., will also cause a reduction in numbers of this beetle. The beetle is unable to develop where pasturing is practiced continuously."

A bibliography of the literature on the described transformations and food plants of North American species of Agrilus (Col.), C. A. Frost and H. B. Weiss (*Canad. Ent., 52* (*1920*), *Nos. 9, pp. 204–210; 10, pp. 220–223*).—The present paper is said to bring together to date all the references to literature on the life history, habits, and food plants of those North American species of the genus Agrilus about which such information is known, supplemented by brief notes on the important economic ones.

Some notes on the genus Trachykele, with a description of a new species (Buprestidæ, Coleoptera), H. E. Burke (*Ent. Soc. Wash. Proc., 22 (1920), No. 7, pp. 168–170*).—*T. hartmani* from the wood of Sargent cypress (*Cupressus sargentii*) at Mount St. Helena, Lake Co., Calif., is described as new.

Spotted apple-tree borer, F. E. Brooks (*U. S. Dept. Agr. Bul. 886 (1920), pp. 12, pls. 5, fig. 1*).—This is a report of investigations of *Saperda cretata* Newman, a species which occurs locally throughout the apple-growing sections of the central and eastern parts of the United States, and is closely allied in habitat, appearance, and behavior with the roundheaded apple-tree borer (*S. candida* Fab.). It is commonly known as the spotted apple-tree borer, the appellation "spotted" referring to the large white spots on the back of the adult. It appears to be entirely absent from many localities within its general range, while in others it is abundant, occasionally replacing to a great extent the roundheaded apple-tree borer. It was found by the author in the vicinity of Lansing, Mich., outnumbering *S. candida* probably 50 to 1, and it has been reported as common in certain parts of Iowa and Wisconsin. The present paper is based largely upon observations of specimens collected as 1-year-old larvæ in Michigan in 1916 and 1917 and transported in the wood to West Virginia, where they were removed from their feeding places and planted in the trunks and branches of living apple trees of various sizes.

The species was first described in 1838 by Newman. The author has definite locality records of this species from Massachusetts, Pennsylvania, Maryland, West Virginia, Michigan, Wisconsin, Iowa, Illinois, Texas, and Ontario, Canada, and the species is also recorded from New York, New Jersey, and Ohio. In addition to apple and wild crab apple, it has been recorded from juneberry and *Cratægus* spp., though the author has never found it attacking juneberry. The injury caused by this borer is very similar to that of *S. candida*, except that it usually occurs higher on the tree. The roundheaded borer almost invariably attacks near the ground, whereas the spotted species distributes its wounds along the central and upper portions of the trunk and among the branches. Small trees and branches, an inch or two in diameter, are most liable to atack.

The beetles issue from the wood in the spring and early summer, having been observed to appear in West Virginia from May 14 to 31, and at East Lansing, Mich., on June 26. After emergence the adults seek the foliage of the trees and feed, at times very freely, on the bark of twigs and leaf petioles, and, occasionally, on the leaves. Oviposition begins three weeks after emergence, and eggs may be laid by an individual female over a period of at least 60 days. The eggs, which are placed between the bark and wood, hatch in about three weeks. In some cases the larval period is two years, in others three years, and occasionally, it covers four years. The full grown larvæ change in the spring to pupæ, in which stage they remain from four to six weeks. The adults remain within their pupal cells from one to two weeks, and emergence therefrom may take place from the first of May to the last of June, according to locality and climatic conditions. About one-half of the beetles observed died within a month after emergence, but a few lived for a considerably longer period. One male attained an adult age of 52 days, while a female lived 93 days, having continued to oviposit up to within a few days of its death.

Woodpeckers, apparently the downy woodpecker (*Dryobates pubescens medianus*), are by far the most effective natural check to the increase of this borer. There appears to be little doubt that in apple orchards which are sprayed with arsenicals for the codling moth and other common insect pests many of the adults of this borer are killed incidentally, since the beetles feed rather freely on

exposed surfaces, especially on the wrinkled bark at the base of twigs where deposits of the poison from sprays collect and adhere. The borers while small can be found and removed from the trees very readily by paring away the bark over their burrows with a sharp knife.

A new genus and several new species of Cerambycidæ (Col.), W. S. Fisher (*Ent. Soc. Wash. Proc., 22 (1920), No. 7, pp. 153–159*).—The genus Anoplocurius is erected for *A. canotiæ* n. sp., and four other species representing the genera Callidium and Ataxia are described as new.

The western pine bark beetle [Dendroctonus brevicomis Lec.], a serious pest of western yellow pine in Oregon, W. J. Chamberlin (*Oregon Sta. Bul. 172 (1920), pp. 30, figs. 8*).—This is a summary of the present status of knowledge of the biology and methods of control of *D. brevicomis*, a bark beetle present throughout the yellow-pine regions of Oregon, often attacking the very finest trees in a stand. Besides the western yellow pine (*Pinus ponderosa*), this beetle also attacks the sugar pine (*P. lambertiana*), the loss caused in sugar pine, however, being negligable. The species is found wherever *P. ponderosa* grows, in British Columbia, Washington, Oregon, California, Idaho, and in parts of Montana, Wyoming, and Nevada. The adult beetles dig through the bark of healthy, injured, fallen, or standing timber and excavate winding galleries in which the eggs are deposited. The eggs hatch in a week or ten days, and the young larvæ bore their winding galleries through the inner bark. The length of the larval stage varies considerably, the summer brood spending 9 to 12 weeks as larvæ, while the overwinter larvæ are in the grub stage for over six months. The pupal stage covers a period of three or four weeks.

The value of the wood of trees killed by this beetle is sometimes reduced by the bluing of the sapwood, often before the needles begin to turn yellow. The loss to standing trees killed by this beetle is negligible if the trees are removed within one or two years. After that time, boring insects, fungi, and storms inflict some loss from year to year, the smaller trees being soon rendered useless, although trees of a breast-high diameter of over 36 in. will remain merchantable for 15 to 20 years.

While but little study has been made of parasitic enemies of this beetle, there is a considerable list of species which parasitize other scolytids. The present methods employed in combating bark beetles are expensive and not altogether satisfactory, but they have proved successful to some extent. The data on the work accomplished in certain areas prove that the beetles can, and have been, reduced from epidemic infestations back to normal, or even below normal, at a cost which was not prohibitive. Among the measures for control are (1) removing bark from standing trees by means of specially constructed tools; (2) destroying the broods without removing the bark, by converting the logs into lumber and burning the slabs, placing the logs in water, piling the logs and scorching the bark sufficiently to destroy the broods, or scoring the upper side of felled trees to allow water to get under the bark and destroy the broods; (3) the trap-tree method of control, which consists in girdling during the time of flight of the beetles with the view to attracting them away from green timber; (4) a modification of the trap-tree method; (5) the 50 to 75 per cent method; and (6) use of portable sawmill. An example of successful control is reported upon.

Report on the white pine weevil [Pissodes strobi Peck], M. W. Blackman (*[Augusta]: Maine Forestry Dept., 1919, pp. 12; abs. in Maine Sta. Bul. 284 (1919), p. 301*).—This report of work carried on in cooperation with the Forestry Department, University of Maine, and the Maine Experiment Station, gives a description of *P. strobi*, and a summary of information on its life history and habits and the damage it causes, together with a discussion of control

measures. The report concludes with suggested systems of planting white pine and Norway spruce to obviate weevil injury. A recent account of this pest by Britton has been noted (E. S. R., 43, p. 251).

Queen rearing, G. C. MATTHEWS (*Univ. Minn. Agr. Ext. Div. Spec. Bul. 49 (1920), pp. 8, figs. 3*).—This is a popular account.

Bumblebees of District of Columbia and vicinity (Hym., Bremus.), L. O. JACKSON (*Ent. Soc. Wash. Proc., 22 (1920), No. 7, pp. 162–168*).—Ten species of bumblebees are recorded. *Psithyrus laboriosus* F. is the only species of the genus occurring in the territory covered.

Insect enemies of the codling moth in South Africa and their relation to its control, F. W. PETTEY (*So. African Jour. Sci., 16 (1919), No. 3, pp. 239–257, pls. 2*).—In studies made by the author, five parasites were found to be of assistance in controlling the codling moth, namely, *Trichogrammatoidea lutea* Girault, *Chalcis* sp., *Pimpla heliophila* Cam., *Trichomona cariniventris* Cam., and *Pimpla* sp. Of these *T. lutea* is the only one of great importance. The investigations here reported indicate that while this egg parasite has little influence on the control of the first generation moths, it prevents the hatching of about 50 per cent of the codling moth eggs from midsummer to the end of the fruit season. *P. heliophila*, which attacks the larvæ and pupæ, is the next in importance as a parasite.

Experiments have shown that the banding of trees is not effective in capturing codling moth larvæ where the Argentine ant visits the trees constantly in large numbers. This ant appears to be of considerable use in the control of the codling moth in orchards where it is very abundant on the trees during the fruit season. Observations were also made of *Liogryllus bimaculatus* Geer and *Coranus papillosus* Thunb. as predatory enemies of the larvæ.

Notes on Gonatopus ombrodes, a parasite of jassids (Hymen., Homop.), C. N. AINSLIE (*Ent. News, 31 (1920), Nos. 6, pp. 169–173; 7, pp 187–190*).—The author presents notes on the habits of *G. ombrodes*, which was observed to attack *Cicadula 6-notata* at Fort Collins, Colo.

The pear cephus, P. PASSY (*Vie Agr. et Rurale, 9 (1920), No. 38, pp. 180–182, figs. 7*).—This is a brief account of *Cephus compressus*, or *Tendredo compressus*, which is an important enemy of the pear in France during the months of May and June.

FOODS—HUMAN NUTRITION.

The significance of defecation in connection with the absorption of the nitrogen of bread made with unbolted flour, E. C. VAN LEERSUM (*Extract from Arch. Néerland. Physiol. Homme et Anim., Ser. 3C, 3 (1919), No. 2, p. 199*).—This work, like earlier experiments by the author,[1] was undertaken to test the proportion of the total nitrogen of the wheat that is utilized by the body when coarse whole wheat bread is consumed in large quantities.

According to the author's previous work, the percentage of nitrogen absorbed varies with the dryness of the feces and becomes greater as the length of time before defecation is increased. In the present experiments, normal subjects were placed upon a diet containing a proportion of bran corresponding to that used in experiments reported by Hindhede. After a preliminary control period a condition of defecation similar to that usual with the subject of Hindhede's experiments was artificially induced by the administration of small doses of opium, and the same diet was continued through three more experimental periods. The stools for the different periods were compared and the nitrogen

[1] Arch. Néerland. Physiol. Homme et Anim., Ser. 3C (1917), No. 3, p. 446.

absorption for each was calculated, the results showing a noticeable increase in nitrogen absorption during the periods when the opium produced conditions of retarded digestion resembling those in the Danish experiments.

A careful study was also made of the nitrogen occurring in different parts of the grain and the comparative availability of that in the endosperm, the germ, the aleurone layer, and the outer coatings. From this it is concluded that the increase in nitrogen absorption which accompanied the retention of the feces was due more to the nitrogen from the endosperm than to the less available nitrogen from the outer portions of the grain, and this is considered further argument against the economy of bran as a source of nitrogen to the human body. In general, the author's experiments are held to indicate that for persons of normal habits of defecation—that is, for the great majority of persons—the consumption of unbolted flour entails a greater loss of nitrogen.

Wheat and the flour mill.—A handbook for practical flour millers, E. Bradfield (*Liverpool: North. Pub. Co., Ltd., 1920, pp. [4]+XI+163, pl. 1, fig. 1*).—This volume consists of a foreword, by R. C Winter; a collection of papers by the author on the theory and practice of modern flour milling; papers on the bleaching of flour, from a chemist's point of view, by W. Jago, and from a baker's point of view, by J. Kirkland; and a paper on chemistry and physics as applied to milling, by F. E. Treharne.

Coconut press cake as a protein-containing food for human consumption, B. C. P. Jansen (*Meded. Geneesk. Lab. Weltevreden [Dutch East Indies], 3. ser. A, No. 1–3 (1920), pp. 1–20, pl. 1*).—Feeding experiments with house rats and digestion experiments with three human subjects are reported, which in general confirm the conclusions of Johns, Finks, and Paul (E. S. R., 41, p. 262) that coconut press cake contains all the essential amino acids for growth and some fat-soluble vitamin. The experiments were undertaken for the purpose of ascertaining whether the press cake would make a satisfactory supplement to two articles of food which were being extensively used by the Malays on account of the dearth of rice. These foods were the so-called "gelang," prepared from the arengo palm, and "nagoer" made from the residue obtained in the preparation of sago from cassava roots. Both foods consisted almost entirely of starch and proved to be entirely inadequate. The use of equal parts of either of these foods with coconut press cake proved satisfactory in both the rat and human experiments.

Milk for the family (*U. S. Dept. Agr., Dept. Circ. 129 (1920), pp. 4, figs. 2*).—This is a short contribution from the Dairy Division of the Bureau of Animal Industry and the Office of Home Economics of the States Relations Service. It points out the importance of milk as a food for the whole family and its very great importance in the diet of the child.

The responsibility of the consumer for food standards and prices, A. F. Morgan (*Univ. Calif. Chron., 22 (1920), No. 3, pp. 316–336*).—This is a general discussion of the cost to the consumer which food law protection has involved, attention being called particularly to the confusion and extra expense involved to the manufacturer and ultimately to the consumer in the varying regulations of the different States. Some of the many points brought out in the discussion are summarized in the concluding paragraph as follows:

"The consumer, through his Government representatives and his own purchasing choice, has in the last 15 years demanded better foods, conforming to uniform standards, put up in pleasing packages, as far as possible ready to eat, and of the brand most widely advertised at the moment. He has insisted that the weight be declared on the label, that the smallest amount possible of preservatives or artificial flavorings and colorings be used, that 'substitutes' be avoided, and that only the superproduct of the farm be brought to his door.

He has cared a little as to the bacterial history of employees in food concerns, and has taken heed of the claims of the pseudo 'food expert' with an axe to grind. In consequence of these demands a cleaner, more appetizing, if no more nutritious food supply is in our markets, and its price is rapidly passing beyond our means."

Analysis of some effects of increased cost of living on family budgets, R. MEEKER and D. D. KITTREDGE (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev., 11 (1920), No. 1, pp. 1–10*).—This article compares the cost of living as determined by the Bureau of Labor Statistics in 1918–1919 by an extensive survey of family expenditures with the results of somewhat comparable figures obtained in 1914 and 1901.

The amount spent for food represented 43.13 per cent of the total expenditure in 1901, 43 per cent in 1914, and 38.2 per cent in 1918–1919. As regards the nutritive values of the diets, it is estimated that the total energy value in 1918–1919 was lower than in 1901, and slightly lower than the accepted standard of 3,500 calories per man per day. There appears to have been a marked falling off in the use of meats, a noticeable increase in the use of milk, a slight but possibly temporary decrease in the use of flour, meals, and bread, an increase in the use of rice, and a decrease, probably temporary, in the use of sugar.

Minimum quantity budget necessary to maintain a worker's family of five in health and decency (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev., 10 (1920), No. 6, pp. 1–18*).—This budget is based on the extensive studies of the cost of living made in 1918 and 1919 by the Bureau of Labor Statistics. The quantity food budget submitted as representing the food requirements of the standard family of five was obtained by averaging the actual amounts of foods used by 280 families, selected from the cost-of-living survey made by the Bureau of Labor Statistics because they averaged in size approximately 3.35 equivalent adult males and in the neighborhood of 3,500 calories of food purchased per man per day. The food budgets were taken in considerable detail, giving, among other things, the amount of each article of food purchased for a year for each family scheduled, and represented about 25 cases from each of 11 representative cities.

"For the most part this average budget contains proteins, fats, and carbohydrates in sufficient quantities and in the right proportions. To make the average food budget acceptable to trained dietitians as a standard food budget, intended to maintain the standard family in health, it was necessary only to reduce slightly the quantity of meat and to increase slightly the quantities of whole milk, fresh vegetables, and fruits."

Relation of urochrome to the protein of the diet, K. F. PELKAN (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 237–242*).—The literature dealing with the specific yellow coloring matter of the urine is reviewed, and a series of experiments is reported in which the urochrome content of 24-hour samples of urine was determined after diets of varying protein intake. The urochrome was estimated by comparing the color of a sample of the filtered urine and of a sample from which the proteins and such colors as urobilin and ureorythrin had been removed by precipitation with lead acetate, with an arbitrary standard of 3.2 mg. of Bismarck brown and 8 mg. of Echtgelb Y in 1 liter of water.

The results of these experiments showed that the daily urochrome output varied directly with the protein intake. The increase on a high protein diet was, however, not so great as the decrease on a low protein diet. This is thought to indicate the inability of the body to deal with more than a limited amount of urochrome. A gelatin diet preceded and followed by a low protein diet did not increase the urochrome excretion.

Preliminary experiments as to the chemical nature of the particular group or groups in the protein molecule to which the color is due led to the isolation from peptone and casein, but not from gelatin, of a substance having the same chemical reactions as urochrome. This has been given the tentative name protochrome.

Water-soluble vitamins, I, II (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 265–294, pls. 3, figs. 6*).—Two papers are presented.

I. *Are the antineuritic and growth-promoting water-soluble B vitamins the same?* A. D. Emmett and G. O. Luros (pp. 265–286).—In this paper evidence is presented which is thought to indicate that the antineuritic vitamin and the growth-promoting, water-soluble vitamin are not identical. The evidence consists of a tabulated summary of the literature dealing with the stability of the water-soluble vitamin toward heat and reports of experimental work in which the same source of water-soluble vitamin was used for studies on polyneuritis in pigeons and on the rate of growth in young rats. The data from the literature are grouped in two tables, one dealing with the temperature of destruction of the vitamin as determined by curative and prophylactic tests with fowls, and the other with the growth rate of young rats. A comparison of these tables shows that both the antineuritic and growth-promoting vitamins were fairly stable at temperatures around 100 to 105° C. but that at higher temperatures the antineuritic vitamin appeared to be less stable to heat and to alkali than the rat growth-promoting vitamin.

In the experimental work reported the basal food employed was unmilled rice, which furnished the only source of the water-soluble antineuritic and growth-promoting vitamins. The rice was heated under different conditions and at different temperatures and fed unground to pigeons as their sole food, and ground to rats, the rice in the latter case being so supplemented with lactalbumin, butter fat, and lard as to form a balanced ration for growth, provided no destruction of the vitamin by heat had taken place. The rice for the various experiments was heated in the air oven at 120° for 2 hours, and in the autoclave at 120° and 15 lbs. pressure for 1, 2, and 6 hours, respectively. The food intake for the rats was determined directly and for the pigeons by calculating the total consumption of rice for the entire group. In the work with pigeons the experiments also included feeding trials with unheated milled rice plus small quantities of extracts of autolyzed yeast heated in the same way as the unmilled rices, and curative trials with extracts of the vitamin before and after heating.

The results obtained in all the pigeon cases indicated that the antineuritic vitamin was partially altered by heating in the air oven at 120° for 2 hours, and totally destroyed by heating for 2 and 6 hours in the autoclave.

In the rat experiments four groups were so fed that a comparison of the rate of growth of each would indicate the relative degree of destruction of the vitamin through heating the rice. The diets consisted of rice 64, lactalbumin 6, butter fat 18, lard 10, and salt mixture 2 per cent in the first period, and the same constituents in the proportions of 89.7, 3.3, 5, and 2 per cent, respectively, in the second period. Control groups were fed unheated, unmilled rice. The increase in the amount of rice fed in the second period was intended to cover the question of partial destruction of the vitamin by heat, but as the 64 per cent ration apparently contained more than the minimum requirement of the vitamin it could not be definitely ascertained whether the vitamin was slightly destroyed. The average results for each group indicated, however, that heating for 2 hours at 120°, either in the oven or autoclave, had but very slight if any effect upon the vitamin. A slight detri-

mental effect was observed as the result of heating the rice for 6 hours in the autoclave. That the destruction under these conditions was only slight was also shown by the fact that rats made rapid growth when 1 cc. of an extract of brewers' yeast, heated in the autoclave for 6 hours at 120°, was added to a diet lacking the growth-promoting vitamin and which had caused definite signs of retardation of growth.

"These findings suggest tentatively, at least, that the antineuritic (pigeons) and the water-soluble B (rats) vitamins are not the same, and that it would be better to consider them as being different until there is further proof to the contrary.

A list of 31 references to the literature is appended.

II. *The relation of the antineuritic and water-soluble B vitamins to the yeast growth-promoting stimulus*, A. D. Emmett and M. Stockholm (pp. 287–294).—In the experimental work reported in this paper comparative trials were made to determine whether or not the extracts that caused increased growth of yeast as determined by the Williams' micro method (E. S. R., 41, p. 670) would cure polyneuritis in pigeons or promote growth in young rats. Samples of unmilled rice were heated 1 hour in the autoclave at 120° and 15 lbs. pressure, 2 hours in the autoclave at 120°, and 6 hours in the autoclave at 120° and 15 lbs. pressure. These samples and a sample of unheated rice were each finely ground and extracted with hot 95 per cent alcohol, and the extracts were concentrated in vacuo, taken up with hot water and salt, filtered, and made up to definite volume.

The varying degrees of heating employed were found to have no effect upon the factor which stimulates growth in yeast, although curative tests on pigeons with equivalent amounts of the same extract, as measured in terms of number of cell units per gram of body weight, showed that the antineuritic vitamin was destroyed by heat. This is thought to indicate that the yeast growth-promoting and antineuritic vitamins are not identical.

The evidence regarding the identity of the rat growth-promoting and yeast growth-promoting vitamins, while not so clear, is thought to indicate that the yeast cell stimulus is not in itself able to retard the loss in weight and promote growth in rats, and consequently is probably not identical with the growth-promoting (water-soluble B) vitamin.

"Whether pigeons or rats require this yeast growth-promoting factor for normal development has not, as yet, been definitely proved. Since the amount of yeast growth stimulus, expressed in terms of yeast cell units per gram of substance, does not appear necessarily to vary directly (in terms of potency) with the antineuritic and water-soluble B vitamins, this yeast method should not be employed quantitatively with too much definiteness until further study is made."

The vitamin content of rice bran, and methods for its determination, B. C. P. Jansen (*Meded. Geneesk. Lab. Weltevreden* [*Dutch East Indies*], *3. ser. A, No. 1–3 (1920), pp. 22–49*).—The author reviews the literature on the extraction of the antineuritic vitamin from rice bran by various solvents, and reports an investigation of the relative value of certain of these solvents as determined by feeding experiments with pigeons and domestic fowls, using the various extracts of the rice bran as curative and protective agents in connection with a polished rice diet. Four methods of extraction were used, (1) with 0.3 per cent HCl for 2 days, (2) with 0.3 per cent HCl for 30 days, (3) with 70 per cent alcohol, and (4) with 96 per cent alcohol and $\frac{1}{15}$ volume of concentrated HCl. In each case 1 kg. of the rice bran was thoroughly shaken with 3 liters of the solvent, allowed to stand for some time, filtered, and the solution evaporated on a calculated quantity of washed white rice. The evaporation was

conducted at a temperature not exceeding 50° C. and hastened by a current of air. The resulting materials contained the extracts from 5, 10, and 15 per cent of the rice bran, preliminary experiments having indicated 30 per cent to be more than sufficient.

In the feeding experiments with healthy cocks the 5 per cent rice bran proved sufficient to prevent polyneuritis with all the extracts except the fourth. With this, one of the three cocks developed polyneuritis. Of three controls fed white rice and 5 per cent of rice bran, two died of intercurrent diseases and the third of polyneuritis. This is thought to indicate that 5 per cent of rice bran is the limit at which an attack of polyneuritis is possible, and that consequently all of the vitamin was extracted by the methods employed.

With pigeons, several developed polyneuritis on the 5 per cent extract but were protected with a 10 per cent extract. This indicated that pigeons are more susceptible to polyneuritis than fowls. Other experiments with pigeons were conducted in which the extract was prepared from another supply of bran which proved to contain considerably less vitamin. This is explained on the ground that the first supply was from freshly cut rice, while the other was from a stock that had been stored for some time. As the result of this experimental work the author recommends as the simplest method of obtaining the most potent preparation extracting with 0.3 per cent HCl, evaporating the extract to a sirup at low temperature, and quickly adding an equal volume of alcohol. A thick precipitate forms which is filtered off, leaving the vitamin in the filtrate.

The author is of the opinion that the best method as yet for determining antineuritic vitamin quantitatively is by feeding healthy fowls or pigeons with washed white rice mixed with the substance to be tested. Curative experiments with polyneuritic fowls are considered to be absolutely worthless. Two means of improving the methods in use are discussed, (1) the use of more susceptible subjects than pigeons and (2) the substitution of a more delicate criterion than the appearance of nerve degeneration. For the first the use is suggested of a species of small birds known as "nonnetjes" (*Munia maja*). These birds are said to contract polyneuritis in less than 12 days. The small size of the birds, moreover, makes it possible to keep several in the same cage and thus eliminate individual errors. A more detailed study of metabolic changes occurring in the development of polyneuritis is thought necessary before a more delicate criterion can be discovered than the characteristic nerve changes.

The respiratory quotient of birds fed on polished rice, B. C. P. Jansen and R. M. M. Mangkoewinoto (*Meded. Geneesk. Lab. Weltevreden [Dutch East Indies], 3. Ser. A, No. 1-3, (1920), pp. 51-65, pl. 1*).—By means of a special respiration apparatus which is described and illustrated, the authors determined the respiratory quotient of rice birds fed on unpolished and polished rice.

It was found that the respiratory quotient of the birds fed on polished rice had a tendency to be lower than that of birds fed unpolished rice. This was, however, not at all regular, and in many cases the fall in respiratory quotient did not occur much before the development of the typical signs of polyneuritis. It is, therefore, concluded that a low respiratory quotient is not at all suitable as a criterion for diagnosing polyneuritis.

Pellagra census in certain districts in Florence, A. Franchetti and M. Zalla (*Bol. Soc. Ital. Studio Aliment., 1 (1919), No. 4-6, pp. 69-82*).—A report is given of the studies of pellagra in certain districts of Florence, Italy, in the latter part of 1919. The data, when compared with earlier reports, show a marked decrease in the incidence of the disease. This is attributed in a large measure to alterations in the diet due to war conditions. Instead of consist-

ing almost exclusively of corn, the war diet had been much more varied, and the high price of pork had also led to its substitution by other products "less costly and presumably more hygienic."

ANIMAL PRODUCTION.

On the origin of germ cells in higher vertebrates, J. FIRKET (*Anat. Rec., 18 (1920), No. 3, pp. 309-316*).—In the young male rat the author finds that the so-called primary germ cells degenerate and do not give rise to spermatozoa. The true germ cells are the "secondary germ cells" which rise after the first have disappeared and differ from them in size and in the arrangement of the mitochondria. In chickens (both sexes) there are also two generations of germ cells. Most of the primary cells degenerate, but a few persist side by side with the secondary germ cells and may form oocytes or spermatocytes. Whether these develop into mature ova or spermatozoa is uncertain.

The observations are thus contrary to the view that the definitive germ cells are set apart very early in fetal life.

[Physiology of reproduction in the rat], J. A. LONG and H. M. EVANS (*Abs. in Anat. Rec., 18 (1920), No. 3, pp. 241-249*).—Authors' abstracts of nine unpublished papers are presented. Changes in the uterus during the estrual cycle are described in greater detail than in a previous note (E. S. R., 42, p. 667), and additional experiments are reported showing the delay in ovulation following mechanical stimulation of the cervix and the inhibitory influence of lactation.

Besides mucus and cellular detritus, the vagina during the quiescent period (stage 4) contains a large number of leucocytes which suddenly disappear at the beginning of the stage preparatory to estrus (stage 0). Unexpected differences between individuals in length of cycle were observed and also aberrant fluctuations in the lengths of successive cycles in the same animal. The first ovulation coincides with the spontaneous opening of the vaginal orifice, which usually occurs before the female is 90 days old, although there was considerable variation in this age.

Removal of the entire uterus, including the cervix, did not influence the regular recurrence of estrus other than through an initial delay in some cases. Double ovariotomy caused a complete cessation of estrus, although it did not influence the one due immediately afterwards. Fourteen cases of successful implantation of ovaries into the spleen, mesometrium, and rectus muscle were secured, and estrus cycles were observed for over four months afterwards. Transplanted ovaries seemed to function normally and contained healthy and atretic follicles, corpora lutea of several ages, and interstitial tissue. "They demonstrate that in the absence of any true ovulation there is nevertheless an apparent rhythmic production of corpora lutea from unburst follicles as is known to occur rarely in normal animals."

During short periods at particular stages of pregnancy and lactation the rats were fed with certain intra vitam stains which were known to color permanently any corpora lutea present at the time of administration but not those formed afterwards. By this means it was possible to distinguish beween the corpora lutea of ovulation, of pregnancy, and of lactation. The latter are produced if the ovulation which always follows parturition does not result in pregnancy and persists throughout the suckling period. They are characterized by small lipoid granules uniformly distributed in the lutein cells and never attain the large size of the corpora lutea of pregnancy.

Effect of underfeeding on ovulation and the œstrous rhythm in guinea pigs, G. N. PAPANICOLAOU and C. R. STOCKARD (*Soc. Expt. Biol. and Med. Proc.,*

17 (1920), No. 7, pp. 143, 144).—The authors report that the underfeeding of guinea pigs may prolong the period between ovulations. The effect was more marked toward the end of the period, due, it is thought, to the greater need of the large developing follicles for food. It is suggested that the variations in the estrual cycles reported for the rat by Long and Evans may be due in part to variations in the diet taken by the individuals.

Retention of dead fetuses in utero and its bearing on the problems of superfetation and superfecundation, A. Kuntz (*Anat. Rec., 18 (1920), No. 3, pp. 295–307, figs. 3*).—Two cases in the cat and one in the dog are described in which fetuses differing markedly in size and development occupied the uterus simultaneously. From the condition of the ovaries and the embryonic vesicles, it is concluded that the eggs which gave rise to the two fetuses were extruded at the same ovulation. The tissues of the smaller fetus in each case showed advanced necrotic changes, indicating that these fetuses had been retained as dead bodies in the uterus for relatively long periods without undergoing extensive autolysis and absorption. It is suggested that in such cases it is not, in general, permissible to conclude that superfetation or superfecundation had occurred.

A biometrical study of crossing over.—On the mechanism of crossing over in the third chromosome of Drosphila melanogaster, J. W. Gowen (*Genetics, 4 (1919), No. 3, pp. 205–250, figs. 2; abs. in Maine Sta. Bul. 284 (1919), p. 300*).—An elaborate statistical study is given of the percentage of crossing over in four regions of the third chromosome of *D. melanogaster*, based on breeding work at Columbia University. The coefficient of the variability is used as a measure of variation in the cross-over percentages. When double crossing over occurs, the two cross-over regions are usually separated by 25 to 35 units.

A case of quadruplets in domestic cattle, with some remarks on the "Kampf der Teile" for food in the ovary, N. G. Lebedinsky (*Verhandl. Naturf. Gesell. Basel, 29 (1918), pp. 60–68, figs. 2*).—The author records the case of a Simmental cow which, after four uniparous gestations, gave birth to four viable young, one male and three female. Two of the heifer calves had similar but not identical color patterns. Fluctuations in the number of young in different species of domestic animals are discussed, and it is suggested that unusually large numbers at a birth result from an increased food supply to the ovary, thereby permitting a larger number of ova to mature.

Poultry notes: Terata (monsters), D. F. Laurie (*So. Aust. Dept. Agr. Bul. 130 (1920), pp. 11, figs. 8*).—Surface views of chicks and ducklings showing double heads and supernumerary heads and legs are illustrated and briefly discussed. What are apparently earlier stages of such double monsters have recently been described by Tannreuther (E. S. R., 42, p. 866).

At what level do the proteins of milk become effective supplements to the proteins of a cereal grain? E. B. Hart, H. Steenbock, and F. Letcher (*Jour. Biol. Chem., 42 (1920), No. 1, pp. 167–173, fig. 1*).—The authors present the results of nitrogen-balance experiments (duration not stated) with 18 hogs fed rations consisting exclusively of corn meal and skim milk, the object being to determine the best proportion of milk for maximum efficiency in growth. As in a previous paper (E. S. R., 42, p. 265) the proportion of ingested nitrogen retained in the body was used as the production value of the mixture tested. The data may be summarized as follows:

Nitrogen metabolism of pigs fed corn meal and different amounts of skim milk.

Ratio milk(l.) to corn (kg.).	Pigs in group.	Live weight (range).	Net available energy per day (range).	Protein in ration.	Nitrogen ingested per day (range).	Proportion of N from milk.	Ingested N retained (average).	Absorbed N retained (range).
		Pounds.	*Therms.*	*Per cent.*	*Grams.*	*Per cent.*	*Per cent.*	*Per cent.*
1:12	4	44- 50	1.57	8 6	8.4	3.2	21.5	29-52
2:12	4	49- 65	1.86-2.12	8.9	10.2-11.6	6 4	22.0	28-57
4:12	4	68-104	2.16-2.43	9 4	12.4-14 0	11 7	25 5	37-54
8 12	3	73- 80	2.25	10 2	13 9	20.7	36.9	56-57
12.12	3	85- 90	2.33	10.9	15.4	28.5	60.2	72-73

"The results show that a highly efficient protein mixture is not obtained until the proportion of liquid milk to corn meal reaches 1 : 1."

Advocates of milk in the human diet are advised to emphasize the unique action of milk in promoting efficient utilization of proteins.

Mineral feeds for farm animals, E. B. FORBES (*Mo. Bul. Ohio Sta., 5 (1920), No. 7, pp. 205-215*).—The author summarizes some of his published work on the mineral metabolism of cows and pigs (E. S. R., 40, p. 373; 42, p. 470), reviews the needs of horses, sheep, and poultry for mineral supplements, reports tests of the palatability of mineral feeds, and describes the various commercial preparations of calcium and phosphorus available for the animal feeder. It is noted that precipitated calcium carbonate is in many ways the most satisfactory calcium preparation, and that this is at present an almost useless by-product of soap manufacture. Steamed bone is considered the most useful source of phosphorus.

Holstein cows on dry feed were offered various mineral supplements. From the amounts consumed it is concluded that they found special steamed bone flour the most palatable and precipitated calcium carbonate the next. Other materials tested were precipitated bone, rock phosphate, marl, and pulverized limestone. The addition of common salt to the bone flour increased the palatability and the addition of acid decreased it.

With pigs the mineral supplements in the order of their decreasing palatability were as follows: Special steamed bone, precipitated bone, pulverized limestone, whiting, precipitated calcium carbonate, rock phosphate, and marl.

Experiments in silage inoculation, Z. N. WYANT (*Abs. Bact., 4 (1920), No. 1, pp. 6, 7*).—This is the author's abstract of a paper read at a meeting of the Society of American Bacteriologists.

Corn was ensiled in cans 2 ft. in diameter which were sunk 4 ft. in the ground. The silos were inoculated in pairs with strains of lactic acid bacteria, salt in the proportion 1:80 being added to one silo of each pair. After four or five weeks the silage was fed to calves and proved very palatable.

About 50 cultures were prepared from the different silos. From the first pair, which were inoculated with a combined culture of *Bacterium lactis acidi* and *B. bulgaricum*, the former organism was recovered without difficulty, the latter not at all. Most of the organisms isolated belonged to three types, viz, short rods in pairs (resembling *B. lactis acidi*), spore-forming rods, and yeasts. Every paired-rod culture changed the pH of dextrose, lactose, or sucrose broth from 7.6 to about 5.5. In only one of the cultures of the spore-forming rods was the acidity increased beynd pH=6.4.

Insure desirable fermentation in your silage, Z. N. WYANT (*Michigan Sta. Quart. Bul., 3 (1920), No. 1, pp. 8, 9*).—The continuation of the experiments noted above is reported to test the value of different proportions of salt added to

corn at the time of ensiling, on the theory that salt would favor the development of lactic acid bacteria in silage as it does in sauerkraut. The salt was dissolved in water to facilitate uniform distribution. Cattle relished the silage when salt in proportions from 1:120 to 1:80 had been added, but higher concentrations were not palatable. The silage had a clean acid odor.

Farmers are advised to try adding about 1 per cent of salt to silage, but it is pointed out that salt will not correct defects due to careless packing.

Report on commercial feeding stuffs, 1919, E. M. BAILEY (*Connecticut State Sta. Bul. 221 (1920), pp. 343–393*).—The proximate composition and retail prices are reported of cottonseed meal, cottonseed feed, linseed meal, wheat bran, wheat mixed feed, wheat middlings, rye middlings, ground barley, corn gluten feed, hominy feed, yellow hominy feed, brewers' dried grains, dried beet pulp, peanut oil meal, coconut oil meal, and various proprietary stock feeds, calf meals, and poultry feeds.

Analyses of three varieties of velvet beans secured from the Bureau of Plant Industry, U. S. Department of Agriculture, are also reported.

Effect of winter rations on pasture gains of yearling steers, E. W. SHEETS and R. H. TUCKWILLER (*U. S. Dept. Agr. Bul. 870 (1920), pp. 20, figs. 8*).—This is a report on steer feeding tests during four years beginning 1914–15 on a farm in West Virginia, in cooperation with the State experiment station. Three lots of 10 steers each were fed the first 3 years and 4 lots during 1917–18. Following the winter feeding period, which ranged from 122 to 134 days in the different years, the steers were grazed on a rather rough bluegrass and white-clover pasture for from 140 to 168 days.

Steers wintered on mixed hay and wheat straw lost in weight during all 4 tests, the average loss being 35 lbs. per head. These steers made an average gain of 309 lbs. on pasture. A ration of corn silage, mixed hay, and wheat straw maintained the steers during 3 winters with an average loss of 1 lb. per head, and the steers gained 317 lbs. on pasture. A ration of corn silage, wheat straw, and cottonseed meal produced gains during all 4 winters, the average being 62 lbs., and the steers gained 262 lbs. during the summer. The silage, straw, and cottonseed meal ration thus produced the greatest gain for the whole year, and was also the cheapest ration fed.

During 1917–18 a lot fed on corn silage and soy bean hay gained 27 lbs. per head during the winter and 240 lbs. during the summer. A comparable lot on corn silage, rye hay, and cottonseed meal gained 11 lbs. in the winter and 281 lbs. in the summer. It is concluded that when a legume hay is used as roughage the protein supplement may be omitted.

It was found that the cost of wintering steers about equaled the difference between the fall and spring prices of steers, but with the purchase of stock in the fall the farmer can control the kind of winter feeding and thereby secure maximum gains in the summer.

Chemical analyses of the feeds offered are included.

Fattening steers, E. L. POTTER and R. WITHYCOMBE (*Oregon Sta. Bul. 174 (1920), pp. 16, figs. 2*).—This is a report of a series of experiments beginning in 1913–14 concerning the fattening of steers (weighing 970 to 1,100 lbs.) during the winter in open lots at the Eastern Oregon Substation. The first year's work involved comparisons of hays fed alone and showed that alfalfa produced over twice the gain of wild hay and over three times the gain of bald barley hay. Subsequent work was, therefore, confined to determining suitable methods of feeding alfalfa hay.

When steers received all the alfalfa they would eat and a ration of 4.8 lbs. of barley during the entire 120-day feeding period or 8.7 lbs. of barley during

the last 60 days, the average daily gain per head was about 1.2 lbs., whereas on alfalfa alone it was 0.92 lb. When silage was fed with the alfalfa the average daily gain per head was 1.93 lbs., while the gain on alfalfa alone was 0.94 lb. Chopping the alfalfa hay instead of feeding it uncut seemed to increase the feeding value about 28 per cent when hay alone was fed, about 14 per cent when fed with barley, and 7 per cent when fed with silage. It is estimated that in most cases the cost of chopping would offset the value of the additional gain. On the average the chopping increased the consumption of hay about 2 lbs. a day.

The combination of hay and silage was the cheapest and most economical ration tested, and cattle feeders of the Northwest are advised to use silage in fattening steers during the winter.

Some of the animals that did not show satisfactory finish in the different experiments were turned on meadow pasture in the spring. The average daily gain on pasture during the first month was 1 lb., during the second month 2.4 lbs., third month 2.3 lbs., and the fourth 0.7 lb. Steers finished on pasture topped the market.

Sheep feeding experiment, H. K. Dean (*U. S. Dept. Agr., Dept. Circ. 110 (1920), pp. 22, 23*).—A group of 29 crossbred lambs averaging 94 lbs. in weight were fed for three months at the Umatilla (Oreg.) Reclamation Project Experiment Farm. During the first month on alfalfa hay alone they lost 5.4 lbs. per head. Corn was then added to the ration, and at the end of the period the gain for the three months averaged 9 lbs. per head and there was a clip averaging 11 lbs. from each.

Sheep and wool for farmers.—II, Cross-breeding for wool and mutton.—Results of experiments, J. W. Mathews (*N. S. Wales Dept. Agr., Farmers' Bul. 132 (1920), pp. 61, figs. 28*).—This account of experiments conducted since the publication of part 1 (E. S. R., 27, p. 873) consists of material previously noted from several sources (E. S. R., 42, p. 869).

Corn by-product for swine, W. L. Robison (*Mo. Bul. Ohio Sta., 5 (1920), No. 9, pp. 247–252*).—This is a report on two experiments in which hominy feed was compared with shelled corn for feeding hogs and four in which corn germ meal was compared with corn or used as a supplement to corn. Experiments 1, 2, and 5 were conducted in the winter, the others during the summer and fall.

Use of hominy feed and corn germ meal for feeding hogs.

Experiment.	Feeds offered.	Duration of test.	Initial weight per head.	Daily gain per head.	Consumed per pound of gain.		
					Corn.	Corn by-product.	Protein supplement.
		Weeks.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	Corn, skim milk	14	71.0	1.74	2.62	....	7.89
	Hominy feed, skim milk	14	70.4	1.39	....	2.71	8.11
2	Corn, tankage (free choice)	15	68.3	1.27	3.99	....	.44
	Hominy feed, tankage (free choice)	15	68.9	1.08	....	3.52	.72
[1] 3	Corn, tankage	16	49.5	1.24	3.29	....	.20
	Corn, corn germ meal, tankage	16	48.1	.98	1.93	1.93	.15
	Corn germ meal, tankage	16	48.9	.68	....	4.49	.15
4	Corn, tankage (12:1)	10	72.5	1.21	3.74	....	.31
	Corn, corn germ meal, tankage (18:4:1)	10	66.1	.92	3.54	.79	.19
5	Corn, tankage (12:1)	14	132.6	1.50	3.96	....	.33
	Corn, corn germ meal, tankage (18:3:1)	14	129.2	1.55	3.47	.58	.19
[1] 6	Corn alone	15	62.4	1.14	4.45	....	....
	Corn, tankage (19:1)	13	59.8	1.31	4.25	....	.17
	Corn, corn germ meal (3:1)	14	60.0	1.21	3.33	.91	....

[1] Hogs on rape pasture.

It is concluded that the hominy feed used was scarcely as valuable pound for pound as corn. It is pointed out that at present manufacturers of hominy extract oil from the germs which are commonly included in the feed, and that this reduction in energy value may account for the comparatively poor results from hominy feed in comparison with earlier results at the station (E. S. R., 31, p. 868).

Corn germ meal alone was found to have a laxative effect. "Apparently for best results it should not constitute a large percentage of the ration and when fed should be used as a partial substitute for both the carbonaceous and the nitrogenous feed."

Chemical analyses of some of the samples of hominy feed and corn germ meal are included.

Factors in soft pork production, P. V. EWING (*Breeder's Gaz., 76 (1919), Nos. 18, pp. 922, 923; 19, pp. 973, 976; 20, pp. 1027, 1028*).—The author discusses the history of the problem of soft pork production to show that at different times and in different localities soft pork has been attributed to a variety of feeds and circumstances. In most places, however, the defect disappeared with increasing use of balanced rations and improved breeding stock.

DAIRY FARMING—DAIRYING.

Studies in milk secretion.—VI, On the variations and correlations of butter fat percentage with age in Jersey cattle, J. W. GOWEN (*Genetics, 5 (1920), No. 3, pp. 249–324, figs. 8; abs. in Maine Sta. Bul. 284 (1919), pp. 291–296*).—This is an elaborate biometrical study of the percentages of fat in the milk produced during the first eight months of 1,713 lactations in a well-established Jersey herd. The methods of treatment were the same as those employed in Study V (E. S. R., 43, p. 676), which dealt with the milk records of this herd.

It was found that the butter fat percentage decreased slightly with age, and on the assumption that the decline is uniform this relationship is expressed by the formula

$$f=5.332-0.0191\ x$$

where f is butter fat percentage and x is the age in years at the beginning of lactation. At the older ages the observed means show considerable dispersion from this line due, it is thought, to paucity of data.

Generalized probability curves were fitted to the frequency distributions of each age, and an extensive series of coefficients are presented showing the correlations between the fat percentages of different lactations taken singly or in groups. These coefficients are deemed useful in estimating the influence of unfavorable environment acting during a particular lactation.

Study VII has already been noted (E. S. R., 43, p. 175).

Conformation and its relation to milk-producing capacity in Jersey cattle, J. W. GOWEN (*Jour. Dairy Sci., 3 (1920), No. 1, pp. 1–32, fig. 1; abs. in Maine Sta. Bul. 284 (1919), pp. 298–300*).—The material in this publication has been noted from an abstract in Maine Station Bulletin 283 (E. S. R., 43, p. 174). It was found that the seven-day test of Jersey cows gave a better indication of the annual yield than the score assigned to the animals by judges.

The relation of conformation to milk yield in Jersey cattle, J. W. GOWEN (*Maine Sta. Doc. 538 (1920), pp. 12, fig. 1*).—This is another abstract of the paper noted above.

Milk, its physiology, analysis, and utilization, A. MONVOISIN (*Le Lait: Physiologie, Analyse, Utilisation. Paris: Asselin & Houzeau, 1920, 2. ed., pp.*

XII+539, figs. 73).—This volume has been extensively revised since the first edition (E. S. R., 26, p. 171), and much new material has been added, including chapters on the structure and function of the udder, the composition of milk in relation to the physiological state of the animal, and the bacteriology of the udder and milk.

Report of the milk committee of the New Jersey Sanitary Association, W. G. TICE (*Pub. Health News* [*N. J.*], *5* (*1920*), *No. 2, pp. 35–39*).—Regulations for the control of market milk are suggested. It is recommended that only three grades be recognized—certified, raw, and pasteurized—and that no milk be sold raw unless produced by healthy cows that have been tested within a year with tuberculin and have not reacted.

Studies in the clarification of milk, C. E. MARSHALL (*Amer. Jour. Pub. Health, 10* (*1920*), *No. 2, pp. 152–154*).—The author summarizes some of the results published in Bulletin 187 of the Massachusetts Experiment Station (E. S. R., 41, p. 278), and presents additional observations on the differences between clarified and unclarified milk.

Upon standing, clarified milk undergoes lactic acid fermentation, and a considerable amount of carbon dioxid is evolved. In the unclarified milk there is more commonly a putrefactive decomposition, molds developed more readily, proteolysis is more marked, and methylene blue is more rapidly reduced. Cheese made from clarified milk had a better flavor than cheese from unclarified milk. The differences noted are explained by the fact that clarification tends to eliminate *Oïdium lactis*, *Saccharomycetes cerevisiæ*, and *Bacillus tumescens*, while retaining most of the lactic acid streptococci and breaking up the colonies of the latter.

Aroma-producer in the souring of cream, F. W. J. BOEKHOUT and J. J. O. DE VRIES (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *49* (*1919*), *No. 14–17, pp. 373–382, figs. 2*).—The authors have isolated from soured milk and cream of desirable odor two strains of an unnamed streptococcus which, when associated with *Streptococcus lacticus*, produces the characteristic aroma of ripening cream. The organism resembles *S. lacticus* in structure but not in cultural characters. Alone it does not produce acid or any perceptible changes in the milk other than a slight sweetening. It utilizes dextrose, lactose, and galactose as sources of carbon, and peptone but not ammonium sulphate, urea, or asparagin as a source of nitrogen. When associated with *S. lacticus* in the absence of casein it did not produce the desired aroma.

The two strains of aroma organisms were killed in 10 minutes at temperatures of 53.5 and 57° C., respectively.

Milk-plant equipment, E. KELLY and C. E. CLEMENT (*U. S. Dept. Agr. Bul. 890* (*1920*), *pp. 42, figs. 23*).—This publication deals with the selection and care of receiving vats, pasteurizing and cooling apparatus, bottle fillers, devices for washing cans and bottles, and minor equipment of the milk plant. The authors include data secured from milk plants throughout the country showing the depreciation in different items of equipment, the loss due to estimating the weight of the milk received from the volume in the cans, the amount of milk collected in drip savers, temperature of milk at different stages during pasteurization by the milk regenerative system, systems of pasteurization used (E. S. R., 42, p. 673), methods of cooling milk, and cost of equipment. Lists of equipment required in plants of various sizes are included.

VETERINARY MEDICINE.

Manual of tropical medicine, A. CASTELLANI and A. J. CHALMERS (*London: Baillière, Tindall & Cox, 1919, 3. ed., pp. X+2436, pls. 16, figs. 909; rev. in Jour.*

Parasitol., *7* (*1920*), *No. 1*, *pp. 50–52*).—This is a revised and enlarged edition of the work previously noted (E. S. R., 24, p. 479), of which the second edition was issued in 1913.

Parasitic diseases in their relation to the live-stock industry of the southern United States, B. H. RANSOM and M. C. HALL (*Jour. Amer. Vet. Med. Assoc.*, *57* (*1920*), *No. 4*, *pp. 394–413*).

Some common parasites of live stock in Colorado, O. G. BABCOCK (*Colo. Agr. Col. Ext. Bul.*, *1. ser.*, *No. 166A* (*1920*), *pp. 19*, *figs. 5*).—This is a popular summary of information on the more important insect enemies of live stock in Colorado.

Fifty years' legislation in relation to contagious diseases of animals, J. PENBERTHY (*Jour. Bath and West and South. Counties Soc.*, *5. ser.*, *14* (*1919–20*), *pp. 21–38*).—A history of legislation relating to contagious diseases of animals in Great Britain.

Report of the State veterinarian, R. O. FEELEY (*Clemson Agr. Col. S. C. Bd. Trustees Ann. Rpt.*, *30* (*1919*), *pp. 169–172*).—Brief statements are made of investigations of diseases of live stock during the year.

Annual report for 1919 of the principal of the Royal Veterinary College, J. MCFADYEAN (*Jour. Roy. Agr. Soc. England*, *80* (*1919*), *pp. 386–395*).—The author reports upon the occurrence of anthrax, glanders, sheep scab, hog cholera, foot-and-mouth disease, rabies, parasitic mange, and mare abortion, and joint-ill in foals.

Poisonous plants of the South, E. D. KING, JR. (*Jour. Amer. Vet. Med. Assoc.*, *57* (*1920*), *No. 3*, *pp. 302–313*).—This paper includes a descriptive list of some of the common poisonous plants which occur in the South.

Baccharis pteronioides as a poisonous plant of the Southwest, C. D. MARSH, A. B. CLAWSON, and W. W. EGGLESTON (*Jour. Amer. Vet. Med. Assoc.*, *57* (*1920*), *No. 4*, *pp. 430–434*, *figs. 2*).—Reports of losses of live stock in the southern portions of Arizona and New Mexico, apparently produced by some plant in the forage, but for which no recognized poisonous plant could be assigned as the cause, have been received for some years. Gradually suspicion became directed to *B. pteronioides*, known locally as "yerba manza," and feeding experiments conducted at the experiment station near Salina, Utah, have definitely demonstrated the poisonous nature of the plant and shown the lethal dose for sheep to be not far from 1 lb. This means that while it is not an acutely toxic plant, it is one of a decidedly dangerous character. While the symptoms exhibited were not distinctly characteristic, and it is necessary to make further detailed experiments with sheep and also cattle, it is considered definitely proved that the plant is poisonous to sheep and probably has a similar effect on cattle. It is pointed out that *B. coridifolia*, commonly known as "mio-mio" or "romerillo," is a well-known cattle-poisoning plant in Argentina, counting among its victims also horses and sheep.

B. pteronioides is a spreading shrub from 1 to 2 ft. in height, with a width often exceeding its height. Its branches are usually biennial, new canes appearing in midsummer after the flowering, which occurs in April or May. The shrub grows in foothills in gravelly or rocky soil of the slopes along the draws, preferring south slopes. Its known range of altitude is from 4,000 to 7,600 ft., but it is more commonly found between 5,000 and 6,000 ft., and occurs from central Mexico through the Rocky Mountains of western Texas north to central New Mexico and eastern central Arizona. It is probable that shortage of other forage is the main cause of animals grazing upon Baccharis, and that losses may be avoided by careful attention to the grazing of the herd. It is especially important that half-fed animals should not be exposed to the temptation of

eating the plant. It is thought that the eradication of this plant will not be difficult or expensive since it is local in its distribution and is easily destroyed, being commonly uprooted by two or three blows of a pick.

The filtration of colloidal substances through bacteria-retaining filters, W. S. Gochenour and H. Bunyea (*Jour. Bact., 5 (1920), No. 4, pp. 363, 364*).—The authors at the Bureau of Animal Industry, U. S. Department of Agriculture, have prepared germ-free filtrates containing proteins unaltered by heat by the following process:

Meat juice from finely ground and previously frozen and thawed raw meat was cleared of the coarser particles by centrifugalization. A small amount of kieselguhr was then added to the clarified juice and the mixture again centrifuged. The supernatant fluid was mixed with a sufficient amount of kieselguhr to make it of the consistency of a thin gruel and this mixture poured directly on a filter candle and filtered with a minimum amount of vacuum. It is stated that the finished product will, on standing or by application of heat, coagulate as completely as the meat juice that has not been subjected to the filtration process, showing that it still contains unaltered proteins. Media prepared in this way are considered superior to media to which meat cubes are added and which are subsequently sterilized by heat.

Observations on changes in virulence of hemolytic streptococci with special reference to immune reactions, Y. Nakayama (*Jour. Infect. Diseases, 27 (1920), No. 3, pp. 270–280*).—A study is reported of the changes in virulence of hemolytic streptococci produced by animal passage, growth in artificial culture, etc., and of the reactions with immune sera of streptococcal strains of varying degrees of virulence. The results are summarized as follows:

"The virulence of a streptococcus rapidly falls on artificial cultivation, particularly on blood agar. The amount of peptone in the medium does not seem to influence the virulence so much as the reaction, acid reaction maintaining virulence better than alkaline. The virulence persists longer in anaerobic than in aerobic conditions. A streptococcus that has been cultivated artificially for some time and has become avirulent increases in virulence for both rabbits and mice on passage through the rabbit. If also passed through mice, the virulence is further increased, especially for mice, and when a certain maximum in virulence has been reached no further increase develops on further passages through mice. When maximum virulence for mice has been established, passage through rabbits may increase the virulence for rabbits but decrease it for mice. On the other hand, if virulence for mice is still on the increase, passage through the rabbit may increase the virulence for both rabbits and mice. Virulence may be increased by keeping streptococci in a collodion sac in the peritoneal cavity of rabbits.

"The agglutinability of a streptococcus may change as the result of animal passage, the particular strain used for immunization being agglutinated more strongly than the related strains by the corresponding immune serum. The original nonvirulent mother streptococcus was agglutinated by all the immune sera. The same relation seems to obtain with reference to opsonins and phagocytosis, as well as with respect to specific precipitation and conglutination, but no differences could be made out between the different strains by means of complement fixation. All the various strains were agglutinated in the same way by acid solution."

Comparative studies of the bactericidal action of normal serum and plasma toward typhoid, paratyphoid B, and anthrax bacilli, W. von Gonzenbach and H. Uemura (*Centbl. Bakt. [etc.], 1 Abt., Orig., 78 (1916), No. 7, pp. 504–526*).—The authors discuss the theory that normal blood serum and plasma

show a selective bactericidal action toward certain organisms, some organisms like typhoid and anthrax bacilli being sensitive to the serum and others like paratyphoid B to the plasma. The results are presented of an extensive series of experiments confirming this theory. The conclusion drawn from the results of experiments arranged to test the bactericidal action of the blood of warm blooded animals for anthrax bacilli are summarized as follows:

The serum of rabbits has strong bactericidal properties for anthrax bacilli. This is thought to be due to the blood platelets, since plasma and serum free from blood platelets are inactive. The blood of man, sheep, and goats in similar experiments proved inactive. Addition of oxalate to a nonbactericidal serum is without effect on the growth of anthrax bacilli. Addition of oxalate to rabbit serum or a mixture of rabbit blood platelets and serum increases the bactericidal properties in proportion to its concentration. The bactericidal constituent of rabbit serum is thermostabile, being unaffected by heating for half an hour at 56° C.

The diagnosis of anthrax from putrefying animal tissues, W. A. HAGAN (*Jour. Bact., 5 (1920), No. 4, pp. 343–350, pl. 1*).—Attention is called to the difficulties experienced in the bacteriological diagnosis of anthrax in suspected material which has undergone putrefaction. These difficulties are considered to be due to diminution in the numbers of anthrax organisms present (owing to lack of oxygen), and to a multiplication of a number of species of organisms closely resembling the anthrax bacilli.

The laboratory procedure used by the author in the examination of suspected material is described, with suggestions as to the best means of differentiating between colonies of true anthrax bacilli and other organisms. The most accurate and rapid method for picking out true anthrax cases is thought to be the direct examination with a high power objective of the minute structure of the suspected colony. This method, while not advocated to supersede entirely the use of guinea pigs in the diagnosis of anthrax, is considered to be a valuable aid in making a rapid diagnosis and to have certain advantages over the use of animals, particularly when dealing with badly decomposed material.

Blackleg immunization and its application in Holland and other countries, J. WESTRA (*Die Rauschbrandimpfungen sowie ihre Anwendung in den Niederlanden und in einigen andern Ländern. Inaug. Diss., Univ. Bern, 1916, pp. 78*).—This dissertation consists of a compilation of information on the etiology, pathogenesis, occurrence, and treatment of blackleg, and a discussion with statistical data of various methods of immunization. A list of 32 literature references is appended.

Antiblackleg serum, M. J. HARKINS and J. E. SCHNEIDER (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 6, pp. 689–691*).—A protection test for the purpose of standardizing various lots of antiblackleg serum has been devised which is said to give consistent and uniform results.

The test consists of the intraperitoneal injection into guinea pigs, of from 400 to 450 gm. weight, of 2 cc. of antiblackleg serum, followed in 14 hours by the subcutaneous injection of 6 mg. of powdered cattle virus suspended in 1 cc. of physiological salt solution. Six animals were used for the test, and at the same time six others were treated in a similar way with normal horse serum and the virus, and 16 others with virus alone.

Of 13 samples of serum subjected to this test, all but one lot protected 100 per cent of the guinea pigs injected, while in the other lot 83.33 per cent of the animals injected were protected. In the control test with normal horse serum and blackleg virus only one animal out of six survived, and in the test with virus alone all of the animals died of blackleg within seven days after the injection of the virus.

A contribution to the knowledge of chicken pox, particularly as regards its relation to avian diphtheria, stomatitis pustulosa contagiosa equi and vaccinia, T. VAN HEELSBERGEN (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 84* (*1920*), *No. 4, pp. 288–303*).—The author concludes that a large majority of cases of avian diphtheria are caused by the chicken pox virus, and that it is quite possible that the Micrococcus of Bordet and Fally is the cause of chicken pox. The chicken pox virus is probably, phylogenetically, closely related to the virus of stomatitis pustulosa contagiosa equi. While it has not been determined that the cowpox virus is identical with that of chicken pox, they are very closely related.

Foot-and-mouth disease, technical considerations, G. M. LE LOUET (*Bul. Agr. Inst. Sci. Saigon* [*Cochin China*], *2* (*1920*), *No. 9, pp. 257–260*).—This is a brief résumé of present opinions concerning the advisability of attempting immunization against foot-and-mouth disease.

Plague-like organisms in the wild rats of Sao Paulo, Brazil, W. G. SMILLIE (*Jour. Infect. Diseases, 27* (*1920*), *No. 4, pp. 378–384*).—"Three strains of bacilli were isolated from normal appearing rats of Sao Paulo, at a time when the city was in close proximity to and in constant danger from bubonic plague. It was proved by cultural methods and animal inoculation that these organisms were not plague but belonged to the closely allied pasteurellosis group. A rapid and sure diagnosis of *Bacillus pestis* is not always a simple matter. One is not justified in relying on one or two modes of differentiation only, but one must apply every differential method known. *B. enteritidis*, which may resemble *B. pestis* somewhat in morphologic and staining characteristics, was isolated from the kidneys of a normal appearing rat. The differentiation between *B. pestis* and *B. enteritidis* is a simple and rapid process."

Tuberculosis eradication: Its aims, methods, and ultimate goal, J A. KIERNAN (*Jour. Amer. Vet. Med. Assoc., 57* (*1920*), *No. 4, pp. 439–452*).

Tuberculosis control in Pennsylvania, S. E. BRUNER (*Jour. Amer. Vet. Med. Assoc., 57* (*1920*), *No. 6, pp. 705–711*).—This is a brief discussion of the author's experience in tuberculosis control, with comments on the various methods of conducting tuberculin tests and illustrative data.

It is reported that from April, 1918, to January 1, 1920, 717 herds comprising 11,730 cattle were tested in 44 counties of Pennsylvania under the officially accredited plan. Of these 941 cattle, or 8.04 per cent, reacted. Initial tests applied to 77 herds showed 70 per cent to be entirely free from tuberculosis. In conclusion certain indispensable requirements for obtaining a tubercuolsis-free herd are outlined.

Accredited herd work in Illinois, J. J. LINTNER (*Amer. Jour. Vet. Med., 15* (*1920*), *No. 9, pp. 412–416*).

The use of bovine abortion bacterial vaccines, H. K. WRIGHT (*North Amer. Vet., 1* (*1920*), *No. 6. pp. 272–275*).—The author discusses methods of controlling bovine abortion, and recommends as the best method a single subcutaneous injection of a large number of living organisms, preferably sensitized with immune serum. The animals in an affected herd should be vaccinated with the exception of those which are pregnant. Two months should elapse after vaccination before breeding.

"The use of living bovine abortion vaccines is not to be regarded as a panacea for abortion. They do, however, offer a means of treatment, based on sound principles, that will aid materially in lessening the losses from infectious abortion.

"The importance of the practice of sanitary measures and the treatment of such conditions as metritis, sterility, and retained afterbirth must not be neglected."

The necessity for eradicating the tick, A. RIVERA (*Dom. Repub. Sec. Estado Agricult., Vulgar. Agr., Hoja 2 (1920), pp. 4, pl. 1*).—This brief account describes the life history of the cattle tick and calls attention to the fact that the cattle industry is losing heavily by the occurrence of piroplasmosis due to *Piroplasma bigeminum*. Plans for a dipping vat, as described in Farmers' Bulletin 603 (E. S. R., 31, p. 776), are included.

Tick eradication in the South, E. I. SMITH (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 4, pp. 423–429*).

The occurrence of gid in sheep [in Saskatchewan], A. E. CAMERON (*Agr. Gaz. Canada, 7 (1920), No. 6, pp. 500–503, figs. 4*).—In this account the author calls attention to the occurrence of the gid parasite in Saskatchewan, where it has been discovered among sheep at the farm of the University of Saskatchewan at Saskatoon during recent months. While there are no other authentic records of its occurrence, it is thought probable that the affection has been more or less prevalent in the Province during the past few years.

Notes and experiments on Sarcocystis tenella Railliet.—III, Is Sarcocystic tenella an aberrant form of one of the Cnidosporidia of insects? J. W. SCOTT (*Jour. Parasitol., 6 (1920), No. 4, pp. 157–166*).—This third paper (E. S. R., 41, p. 379) has been summarized as follows:

"*Sarcocystis tenella* is apparently not an aberrant form of one of the Cnidosporidia of insects, for lambs become infected with this parasite without insects being present. Darling's hypothesis is therefore probably untenable. It has been found that lambs are more certain of becoming infected, and that the number of parasites per unit of muscle is greater if they are kept closely confined in a screened cage than if they are allowed to run free in an open dry lot. A second host other than the sheep does not seem necessary for the development of *S. tenella*, and this being true, a sexual stage of this parasite will no doubt be found in the intestine of the sheep. The method of transmission and life history will be taken up in the next paper."

A possible intermediate host of Fasciola hepatica L. 1758 in North America, M. F. BOYD (*Jour. Parasitology, 7 (1920), No. 1, pp. 39–42, figs. 2*).—Preliminary experiments at Galveston, Tex., with *Physa fontinalis acuta* Drap. are reported. The question as to whether the larval cycle of the liver fluke (*F. hepatica*) can be completed in this form has not been definitely determined.

Sanitary measures that help to save the pig crop, H. B. RAFFENSPERGER (*Amer. Jour. Vet. Med., 15 (1920), No. 9, pp. 409–412, fig. 1*).

Preliminary report on abortion in swine caused by Bacillus abortus (Bang), F. M. HAYES and J. TRAUM (*North Amer. Vet., 1 (1920), No. 2, pp. 58–62*).—The authors report an investigation of three recent outbreaks of infectious abortion in swine in California.

Six abortions occurred in one month in one herd containing approximately 35 brood sows, and the same number in another herd of 35 brood sows, 8 boars, and 30 gilts. In a third herd of 100 brood sows, 29 abortions occurred in two months. From all tissues submitted for examination *B. abortus* was readily isolated on ordinary culture media under aerobic conditions. Smears stained directly from the chorion of the fresh placenta and from vaginal discharges showed an abundance of fine Gram-negative rods of *B. abortus*. Agglutination tests indicated that sows giving strong reactions may give birth to apparently normal litters, and also that sows soon after abortion may fail to react. Comparative agglutination tests with strains from cattle and from these hogs agreed in a general way when tested against the same sera.

While in the three herds examined there was no direct evidence of infection from cattle, the possibility of such infection could not be entirely

eliminated. It is, therefore, recommended that hogs be kept separate from cows and new-born calves, and that milk and milk products be pasteurized before feeding to hogs.

Experimental transmission of equine infectious anemia to the pig, HABERSANG (*Monatsh. Prakt. Tierheilk., 30 (1919), No. 3–4, pp. 171–176; abs. in Trop. Vet. Bul., 8 (1920), No. 2, p. 147*).—Experiments conducted led the author to conclude that the pig is susceptible to the form of infectious anemia occurring in the horse in Germany, and may act as a carrier of the disease.

The horse—in health, accident, and disease, F. T. BARTON (*London: C. Arthur Pearson, Ltd., 1920, pp. 235, pls. 8, figs. 3*).—A popular account.

Studies on anthelmintics.—IX, Santonin, M. C. HALL (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 4, pp. 453–459, fig. 1*).—This is in continuation of the report of investigations previously noted (E. S. R., 43, p. 381).

Experiments in which santonin was administered to dogs indicate that in single dose santonin fails to show a very high anthelmintic value against ascarids, even when used in doses of ½ grain per pound of live weight. In repeated doses it mainfests what appears to be a cumulative action against ascarids, gradually clearing them out. Repeated daily doses of 1 grain each of santonin and calomel will ultimately clear out whipworms. It is shown that santonin is entirely without value against hookworms and Dipylidium, the use of over 1 dr. of santonin in three months having no effect on hookworms and Dipylidium in the case of one dog, and the use of ½ grain per pound, or 8½ grains, having no effect on Dipylidium in the case of another.

Studies on anthelmintics.—X, Stock tonics and some of their constituents, M. C. HALL and M. WIGDOR (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 6, pp. 686–688*).—This is in continuation of the report of investigations above noted. It is pointed out that the mineral mixtures or stock tonics commonly employed are of very little value as anthelmintics.

RURAL ENGINEERING.

The flow of water in concrete pipe, F. C. SCOBEY (*U. S. Dept. Agr. Bul. 852 (1920), pp. 100, pls. 12, figs. 3*).—Part 1 of this report deals with the flow of water in concrete pipe under pressure. The results of 130 observations on 30 separate pipe, of which 29 ranged from 8 to 63.5 in. in diameter and 1 was 120 in. in diameter, are presented. The mean velocities ranged from less than 1 ft. to more than 9 ft. per second. Seventeen pipe were of the dry-mix, cement-washed, jointed type; 5 were of the wet-mix, oiled-form, uncoated jointed type; 3 were constructed in the same manner and then washed with cement; 1 was of the wet-mix, monolithic, steel-form, coated type; 3 were of the wet-mix, monolithic, wood-form, uncoated type; and 1 of the same construction coated. All but two of these pipe were under pressure.

On the basis of these experiments the following formulas, which differentiate between various classes of concrete pipe by means of a coefficient of retardation, were derived:

$$V = C_s H^{0.5} d^{0.625}$$

$$H = \frac{V^2}{C_s^2 d^{1.25}}$$

$$Q = 0.00546\ C_s\ d^{2.625}\ H^{0.5}$$

In these V is the mean velocity of the water in feet per second, H is the head of elevation lost through friction per 1,000 linear feet of pipe, *d* is the mean diameter of pipe in inches, C_s is the coefficient of retardation, and Q is the mean discharge of the pipe in second-feet.

The pipe tested were found to fall into four different classes with reference to conditions covering the coefficient of retardation. Those falling in class 1, which are old California cement pipe lines with rough joints, are given a coefficient of retardation of 0.267. Class 2 pipe, or modern dry-mix concrete pipe and monolithic concrete pipe and tunnel linings, made over rough wood forms, are given a coefficient of retardation of 0.31. This class also includes pipe with surfaces as left by the cement gun process and 2-ft. pipe sections of dry mixture washed with cement mortar on the inside. Class 3, or small wet-mix pipe in short units and dry-mix pipe in long units, are given a coefficient of retardation of 0.345. This class also includes average monolithic pipe made on steel forms, small cement-lined iron pipe, and concrete pipe made under pressure, with interior coating of neat cement applied with a mechanical trowel. Class 4, or glazed interior pipe and large cement-lined iron pipe, are given a coefficient of retardation of 0.37. This class also includes monolithic pipe lines, where joint scars and all interior surface irregularities are removed, and jointed lines of units, made from wet well-spaded concrete, deposited against oiled steel forms.

Data are given on design of concrete pipe lines based on the formulas derived in these experiments.

Part 2 of the report deals with the flow of water in grade line pipe, or pipe partially filled. In this work the coefficient of retardation was computed from five of the best known formulas in use in this country for the design of open channels. It is the opinion of the author that the Kutter, Manning, and Williams-Hazen formulas can be applied with much more accuracy than the Bazin formula if a constant retardation factor is to be used for a given surface. The Kutter formula appears to be applicable and, owing to its universal use, the following values of *n* are recommended: 0.0115 for glazed pipe, practically perfect in both surface and joints, and conduits carrying filtered water or water from which deposits or growths do not accrue; 0.012 for well-made pipe and conduits, with first-class joints and good surfaces, and smooth monolithic pipe or tunnels, when new and clean, for waters from which deposits are not expected; and 0.013 for well-made pipe, carefully jointed or monolithic without appreciable shoulders, for waters containing a small amount of sewage. This value may be used also for designing sewers where conditions are such that high velocities may be attained with flushing streams. It is also applicable to storm sewers which carry but little deposit-creating material at peak load, but which may have a heavy deposit of grease at the high-water line of ordinary sewage flow.

It is concluded that the same values of *n* may be used in the Manning formula for this purpose as are used in the Kutter formula. In the use of the Williams-Hazen formula, values of the coefficient of retardation of 140, 130, and 120 are recommended for the conditions described for the values of *n* in Kutter's formula.

Abstracts of reports of experiments made by agencies other than the Irrigation Investigations Division of the Bureau of Public Roads covering tests made on pressure pipe and pipe partly filled are appended, together with discussions of the entire report by K. Allen, A. S. Bent, F. C. Finkle, A. Hazen, J. B. Lippincott, and H. D. Newell.

On the self-purification of rivers and streams, A. E. Cooper, E. A. Cooper, and J. A. Heward (*Biochem. Jour., 13 (1919), No. 4, pp. 345–367*).—Investigations are reported in which comparisons of the rates of oxidation of the constituents of sewage or sewage effluents in different river waters and in tap and distilled waters were made.

It was found that fully aerated sewage effluents and polluted river waters may contain considerably less dissolved oxygen than distilled water under the same experimental conditions. The low results appeared to be due to various factors and could not be prevented by any method so far employed. As the oxygen content was still the same after incubation for five days and subsequent reaeration, there is thought to be no appreciable error involved in Winkler's dissolved oxygen absorption test.

The oxidation of the constituents of sewage proceeded much more slowly at 10° C. (50° F.) than at the standard temperature of 18.3° usually employed. At temperatures of 22 and 37° oxidation may proceed either at the same rate as at 18.3° or sometimes faster. The results showed the necessity of adhering strictly to a definite temperature in the dissolved oxygen absorption test. Attempts to shorten the five days' dissolved oxygen absorption test to two days were not successful, as owing to an initial lag variable ratios between the two and five days' tests were obtained. A bad effluent may give very little indication of oxygen absorption in two days. Dilution appeared to have comparatively little influence on the rate of oxidation of the constituents of sewage. Ammonia up to a concentration of 45 parts per 100,000 had also only a slight inhibitory effect on the rate of oxidation. Oxidation of sewage constituents may proceed at considerably different rates in river waters of different geological source. The results are, however, very variable, and it is not yet considered possible to draw any definite conclusions as to the influence of geological factors upon the oxidation processes.

It is concluded that in the standardization of sewage effluents the river water into which the effluent is actually discharged must be used for dilution in Winkler's dissolved oxygen absorption test, unless it can be conclusively shown by several experiments that reliable results can be obtained by employing a more convenient diluting medium. It is considered likely that the oxidation processes in artificial methods of sewage purification may be affected by the nature of the water supply and by surface water entering the drainage system. Both hard and soft tap waters may exert a very considerable inhibitory action in laboratory experiments. It is therefore recommended that allowance for possible inhibitory factors always be made in preparing new schemes of sewage purification so that additional filtering area can be subsequently added, if necessary, with minimum trouble and expense. The oxidation by permanganate, unlike the dissolved oxygen absorption test, did not appear to be affected by the presence of waters of different geological source.

It is finally concluded that the permanganate test is more suitable for the chemical examination of water supplies, while the dissolved oxygen test is more suitable for the standardization of sewage effluents.

Bacteriological studies of biological purification, J. GROENEWEGE (*Meded. Geneesk. Lab. Weltevreden [Dutch East Indies], 3. Ser. A, No. 4 (1920), pp. 66–125, pl. 1; also in Bul. Jard. Bot. Buitenzorg, 3. ser., 2 (1920), No. 2, pp. 203–236, figs. 6*).—Attention is drawn to the present lack of knowledge of the purification processes in septic tanks, and the results of studies of the gases formed in septic tanks under certain conditions are reported. These gases were found to generally include methane, carbon dioxid, hydrogen, and nitrogen. Methane is apparently formed in large quantities.

The breaking down of the carbohydrates and albuminous matter in sewage and the formation of hydrogen, carbon dioxid, and hydrogen sulphid are considered to make up the first phase of the purification process. The second phase is considered to be the formation of methane, since the end products of

the first phase were found to be excellent nutritive media for the methane-forming organisms. Methane formation was found to proceed slowly at first, but aided by the proper flow of sewage through the tank reached a point of high activity after two or three months. The constant addition of new matter in the sewage, such as sources of hydrogen, sulphur, and carbon dioxid, was found to hinder methane formation. Biological evidence of methane formation was always found in the sludge of properly operating septic tanks, although the active flora of such sludge was usually quite sparse. It was found that a condition of equilibrium of methane formation is maintained in a properly operating septic tank through the addition of new sewage and the proper draining off of the effluent. Methane formation is therefore considered to be an important factor in the design and operation of a septic tank.

Hydrogen formation was found to result almost exclusively from anaerobic processes, including the fermentation of carbohydrates, albuminous matter, and formic acid salts. Part of the hydrogen formed was found to combine with carbon dioxid, forming methane, this taking place in both the liquid and sludge. Carbon dioxid formation resulted from the methane and all of the hydrogen-forming processes. Large quantities of carbon dioxid escaped in the effluent, so that the carbon dioxid content of the escaping gases from a septic tank can not be taken as a measure of the carbon dioxid formation in the tank.

Nitrifying bacteria were found to be quite active in septic tanks. Their action was hindered by cutting off ventilation and by the entrance of a too high concentration of organic matter. Nitrogen in the escaping gas was found to result from the nitrification of absorbed ammonia to nitrites which, when in solution, were attacked by denitrifying bacteria and reduced to gaseous nitrogen. Thus it was found that nitrogen escapes in the gases from open ventilated tanks but not from closed unventilated tanks. The presence of easily assimilable organic matter was found to most strongly retard nitrification.

Analyses of gases escaping from septic tanks showed that there is more carbon dioxid and methane formed in closed than in open tanks, and that the methane content of the sewage at the entrance of a tank is usually greater than at the outlet. Thus nitrites are formed under conditions which hinder methane formation.

Studies on the influence of velocity of flow in a septic tank on the escaping gases showed that with the same velocity the open tank produced more nitrogen and less methane than the closed tank. Decreasing the velocity of flow decreased the carbon dioxid production and increased denitrification, but owing to the increase in organic matter decreased nitrification.

Studies of the distribution of nitrites and methane showed that nitrification and denitrification processes were taking place at the surface and gradually decreased to a certain depth, where they suddenly ceased entirely. At this point methane formation begins. It is thus concluded that methane formation is regulated entirely by the nitrites present and not by the addition of compounds which are easily fermented to methane and carbon dioxid. It was also found that hydrogen sulphid usually exists in the deeper layers of sewage in properly operating tanks owing to a proper regulation of nitrification.

Surface water supply of south Atlantic slope and eastern Gulf of Mexico drainage basins, 1917 (*U. S. Geol. Survey, Water-Supply Paper 452 (1920), pp. 64+XXVIII, pls. 2*).—This report contains the results of measurements of flow made on streams in 10 river basins of the south Atlantic slope and eastern Gulf of Mexico drainage basins during the year ended September 30, 1917, together with the usual appendix of gauging stations and publications relating to water resources.

Surface water supply of Pacific slope basins in California, 1917 (*U. S. Geol. Survey, Water-Supply Paper 461 (1920), pp. 314+XXXVII, pls. 2*).—This report, prepared in coöperation with the State of California, presents the results of measurements of flow made on streams in 21 drainage basins of the Pacific slope in California during the year ended September 30, 1917, with the usual appendix of gauging stations and publications relating to water resources.

Border irrigation [at the Umatilla (Oreg.) Reclamation Project Experiment Farm], H. K. Dean (*U. S. Dept. Agr., Dept. Circ. 110 (1920), pp. 17–19, figs. 2*).—Border irrigation experiments consisting of studies of length and width of border are reported. The first series included borders 100, 175, and 250 ft. long and 22 ft. wide, and the second, borders 20, 25, 30, 35, and 40 ft. wide and 200 ft. long. The average quantity of water used in the length-of-border experiments increased with the length of border, but this increase was much less for the first 75 ft. of additional length than for the second 75 ft. The average water requirement in acre-feet per acre was 4.18 for the short plat, 4.86 for the medium plat, and 6.45 for the long plat.

In the width-of-border experiments the quantity of water in acre-feet per acre required to irrigate the 20 and 25 ft. borders was the same. The 30-ft. border did not require excessive amounts of water, but the 35 and 40 ft. borders did. The water required for a single application was in the same proportion as the total quantity used.

It is the opinion that border irrigation is more economical of water and labor than flooding or furrow irrigation.

Public Roads (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 28, pp. 24, figs. 12*).—This number of this periodical contains the following articles: Soil Pressure Cell Measures Accurately to Tenth of Pound, by A. T. Goldbeck (see below); Illinois Builds Roads Despite Car Shortage; Shifting Sand Stopped with Oil on Oregon Federal-Aid Projects, by A. F. Morris; Motor Trucks on Eastern Farms; British Road Conditions and Highway Administration; Wisconsin's Maintenance Policy; Valuable Study of Movement of Capillary Water in Soil, an abstract of Bulletin 835 (E. S. R., 43, p. 722); Maintenance on English Roads; Pennsylvania Automobile Registrations During 1920; Educational Conference on Highways and Transportation; Bureau Assists in Car Allocation; and Federal-Aid Allowances—Project Statements Approved in July, 1920.

Soil pressure cell measures accurately to tenth of pound, A. T. Goldbeck (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 28, pp. 3–6, figs. 6*).—A detailed description of this device for measuring pressures in soils is given. A briefer description was noted in a previous report of experiments using the apparatus (E. S. R., 41, p. 582).

Machines and implements for potato culture, H. Wirth (*Mitt. Deut. Landw. Gesell. Österr., No. 12 (1918), pp. 55, figs. 36*).—Different machines for the planting, harvesting, and sorting of potatoes are described and illustrated, and comparative tests of different makes are reported.

Belting: Its use and care on the farm (*Farm Impl. and Tractors, 34 (1920), No. 4, pp. 26, 84, 85, figs. 3*).—General information on belting for farm machinery is given, including data on pulleys for different speeds on different makes of tractors and a formula with which to determine belt horsepower.

Clay structures, C. Küntzel (*Arb. Deut. Landw. Gesell., No. 301 (1919), pp. 20, figs. 17*).—This publication briefly describes the use of clay for the construction of farm buildings and structures in Germany. It is used principally in wall construction, apparently in relatively thick sections, together with wood frame construction.

Windows for rural habitations, M. Ringelmann (*Jour. Agr. Prat., n. ser., 33 (1920), Nos. 10–11, pp. 193–196; 12–13, pp. 217–219, figs. 7*).—Data are given

on the design of windows for rural dwellings, with particular reference to French practice.

Brood coops and appliances, D. M. Green (*U. S. Dept. Agr., Farmers' Bul. 1107 (1920), pp. 8, figs. 6*).—Very brief and popular information on the planning and construction of brood coops and appliances is given.

RURAL ECONOMICS AND SOCIOLOGY.

The cost of producing wheat and other crops in North Dakota in 1919, R. E. Willard (*North Dakota Sta. Bul. 142 (1920), pp. 20, fig. 1*).—The data presented in this bulletin were secured from three sources, the first, meetings of farmers held during the winter of 1919–20 in Barnes, Grand Forks, Pembina, Pierce, and Stutsman Counties in North Dakota, in which the assembled farmers were asked to agree on the various charges to be entered in a schedule of items which was presented to the meeting. In the second case records were secured by the survey method by representatives of the Office of Farm Management of the U. S. Department of Agriculture in the fall of 1919 pertaining to the cost of production of wheat on 78 farms, one-half of which were located in Grand Forks County and one-half in Morton County. The third set of cost data is the result of actual records kept by 36 farmers of the State cooperating with the college.

"The average acre cost of wheat on over 350 farms in 1919 was $19.88, and the cost per bushel was $2.75. The acre cost ranged from $8.53 to $35.47, and the cost per bushel ranged from $1.21 to $14.38. The average yield per acre on these farms was 7.2 bu., and the range in yield was from 1 to 17.5 bu. per acre.

"Fifty per cent of the wheat produced on 113 farms was raised at a cost of approximately $2 per bushel or less, but one-half the farmers produced wheat at $3 or more per bushel.

"The average acre cost of wheat, oats, barley, millet hay, and flax is approximately the same in localities of similar conditions, the averages for these crops ranging from $19.49 to $21.66 per acre in eastern North Dakota and from $13.30 to $18.54 in the western part of the State.

"Indications point to a cost of about $25 per acre for corn raised for the grain and about $33 per acre for silage corn in the silo, the yield of the former being 17.5 bu. and of the latter 4.5 tons.

"Comparison of costs from the three sources of information indicate that any one of the methods may be used with safety for arriving at general results of cost."

Farm management [investigations in Ontario in 1919], II, A. Leitch (*Ontario Dept. Agr. Bul. 278 (1920), pp. 39, figs. 3*).—Investigations made during the year beginning March 1, 1919, by the department of farm management at the Ontario Agricultural College into the economic conditions of three important types of farming, beef raising, mixed farming, and dairying, during the crop year of 1918 are reported on here. The objects of the investigation were to secure reliable information based on existing average farm conditions, to determine the factors having greatest influence in raising or lowering farm profits, to suggest the most profitable form of organization, and to determine costs of production of the farm products. Complete statements of farm transactions for a whole year on from 300 to 400 farms in each of the areas in Middlesex, Dundas, Dufferin, Peel, and Wellington Counties recorded the number of acres under each crop grown and in pasture, waste, or woodlot, the yields of various crops and amounts sold, the amount of feed on hand at the beginning and end of the year and the amount purchased, the inventory of kinds of live stock, receipts from all live-stock products, current expenses, and valuation of

buildings and machinery and of the farm itself. Tables showing these various details on different sized farms are given.

From data derived from 385 beef-raising farms in Middlesex County some of the conclusions are that the farmer who receives from 30 to 40 per cent of his gross revenue from cash crops and the remainder from live stock will be ultimately most successful, that labor income advances steadily with increased crop yields, especially if the crop is marketed to farm live stock of a quality that gives a higher return for feed consumed, and that there is good reason for pasturing from one-third to one-half of the total tillable area on farms of 200 acres or more. The investigation of cost of producing beef (pp. 11–14) was prepared by C. M. Nixon.

The survey of 329 mixed or general farms in sections of Dufferin, Peel, and Wellington Counties indicates that the farmer can make maximum profits on 150 to 200 acres. The effects of high crop yields and good live stock are studied and compared, increased profits from improving live stock being larger than those derived from better crop yields. Since potato growing was an important part of the farm business, the effect on farm profits of growing different amounts of potatoes was noted. Those farms which raised three acres or more were able to add from \$40 to \$60 per acre clear profit to the business for each additional acre grown.

The records of 320 dairy farms in Dundas County, taken in continuation of the survey noted below, were analyzed to indicate the influence of size of farm, live stock, and side lines on farm profits. A chapter is given to a summary of these farm business statistics, together with results from the Oxford survey, previously noted (E. S. R., 43, p. 291).

The dairy farming business in eastern Ontario (*Guelph, Ontario: Ontario Agr. Col., Dept. Farm Management, 1918, pp. 18*).—This survey was made of 340 farms in Dundas County, Ontario, along the general plan of one previously noted (E. S. R., 42, p. 688).

The Japanese in rural Los Angeles County, R. F. BURNIGHT (*Studies Sociol. [Univ. South. Calif.], 4 (1920), No. 4, p. 16*).—The main purpose of this study was to investigate two charges, namely, that Japanese farmers mine the fertility of the land and that they buy immense amounts of land in the name of their children. The first was found to be more or less true, owing to terms of leasing, but the second was refuted. The main problems are said to be competition in labor and the lower standard of living. Sane efforts at Americanization through the educational system, church missions, and Japanese organizations are urged.

The recent agitation among share renters, G. TASSINARI (*Italia Agr., 57 (1920), No. 6, pp. 161–164*).—This author attributes the unrest among agricultural laborers and tenants to the general unrest existing in Italy since the war and to propaganda rather than to adverse economic conditions. He cites data from official inquiries which show that returns from share renting were higher in 1916, 1917, and 1918 than in the period 1909 to 1914. He urges, however, more definite terms of contract.

The movement for cooperative organization and mutual insurance in Italy, G. COSTANZO (*Vie Agr. et Rurale, 9 (1920), No. 27, pp. 25–32*).—This comprises notes on various forms of cooperative organizations for agricultural production, credit, purchase and sale, and insurance.

New tendencies in agricultural legislation in Italy, G. CARRARA (*Vie Agr. et Rurale, 9 (1920), No. 27, pp. 22–25*).—These pages summarize recent legislation encouraging an increase in agricultural production and the formation of

cooperative organizations and regional chambers of agriculture, as well as the improvement of rent contracts.

Outline study in Christianity and rural life problems, A. E. HOLT (*Boston: Social Serv. Dept. Congregational Churches, p. 30*).—Ten chapters of this work are outline studies of 10 conferences held at the Kansas State Agricultural College dealing with social and economic problems of rural life.

Rural life for women, A. C. TRUE (*Assoc. Mo. [Y. W. C. A.], 14 (1920), No. 9, pp. 440–442, figs. 2*).—Comment is made on the survey previously noted (E. S. R., 43, p. 894) emphasizing the growing sense of the need for labor-saving in the farm home.

Community halls (*Ontario Dept. Agr. Bul. 279 (1920), pp. 12, figs. 16*).—This notes the act and regulations giving assistance to rural communities in establishing community halls and athletic fields in Ontario. It is illustrated with drawings of three types of community buildings.

The country theater, A. M. DRUMMOND (*Cornell Reading Course for the Farm, No. 153 (1920), pp. 214–232, figs. 9*).—An experiment in "little theater" activities at the New York State Fair in 1919 is described. A list of plays deemed suitable for community presentation in rural districts is given with comment.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 2 (1920), Nos. 15, pp. 225–240, figs. 2; 16, pp. 241–256, figs. 2; 17, pp. 257–272, fig. 1; 18, pp. 273–288, fig. 1*).—The usual weekly and monthly summaries, brief articles on domestic movement, imports and exports, prices of specified commodities, and marketing conditions for important classes of agricultural products, and foreign market information are given in these numbers.

A study of corn prices in the past 10 years, a monthly review of fresh meat markets, and articles pertaining to vegetable, orchard grass, and millet seeds also appear in No. 15. In No. 16 it is noted that oat prices have declined. Special articles on car lot shipments of northern potatoes and movement and prices of clover and alfalfa seeds are offered, together with an outline of the trend of hog prices covering the period since January 1, 1919, when control by the United States Food Administration was removed. The cold storage report in No. 17 indicates rapidly decreasing holdings, and analysis of the world situation in regard to cereals is made in the same number. Special articles in No. 18 indicate practically universal declines in prices of agricultural products.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 6 (1920), No. 10, pp. 109–120, figs. 19*).—The usual monthly estimates of acreage and production, brief articles, notes, and tabular data as to stocks, condition, and value of important agricultural products are presented. Index numbers of prices of meat animals and certain important crops, 1911–1920, inclusive, are given and also a brief article on the relation between the annual precipitation and the number of head of stock grazed per square mile in four districts (E. S. R., 43, p. 717). A series of charts indicate the approximate dates of sowing and harvesting of cereal crops, flax, potatoes, and tobacco.

Agricultural statistics of Uruguay (*An. Estadís. Agr. [Uruguay], 1918–19, pp. XLIV+315*).—In this report are continued data previously noted (E. S. R., 41, p. 295).

The feeding of the United Kingdom, R. H. REW (*Jour. Roy. Agr. Soc. England, 80 (1919), pp. 1–21*).—Estimates based on a report on the agricultural output of Great Britain (E. S. R., 37, p. 392) are presented to indicate the main sources of supply of food in the United Kingdom before the war, also the extent of that supply coming from within the empire and from foreign countries. A summary of statistics contained in a report on the food supply in the period

1909–1913 (E. S. R., 37, p. 890) is given. The effect of war conditions upon the production and importation is also noted.

Cufra, E. Ceriani (*Bol. Soc. Africana Italia, 39 (1920), No. 3, pp. 97–126*).—In this article are described the geographical position, population, customs, economic conditions, and limited agricultural activities of this group of oases near the center of the Libyan Desert.

AGRICULTURAL EDUCATION.

Proceedings of the joint convention of the National Society for Vocational Education and the Vocational Education Association of the Middle West, Chicago, February 19, 20, 21, 1920 (*Natl. Soc. Vocat. Ed. Bul. 32 (1920), pp. 255, figs. 3*).—These proceedings comprise six sections, of which one deals with agricultural education and another with future problems of national and State administration of vocational education. Among the reports of special committees and the papers presented, with discussions, are the following:

Effect of the Smith-Hughes Law on Instruction in Agriculture, by J. A. James.—According to this special committee report, this law during the first three years of its operation has resulted in nationalizing vocational agricultural education, universalizing and vocationalizing agriculture, emphasizing the responsibility of the high school for agricultural education, assuring that agriculture should function at home, enlarging the scope of agricultural instruction, and demanding trained teachers of agriculture.

Teacher Training in Service from the Standpoint of the College Teacher Trainer, by W. F. Lusk.—In the author's opinion the ideal plan for teacher training would assign two men to the work who should alternate, preferably by terms or semesters, between training in service and class training. The teacher trainer should deal in the field in general with the product of his own department, and particularly with those who are engaging in their first teaching work, and should limit his work to problems dealing with the technique of teaching.

Improvement of Teachers in Service, by J. D. Blackwell.—The author describes the plan for the improvement of teachers being carried out in Texas through monthly supervisory visits, the summer school, conferences of teachers of vocational agriculture, community activities, and office supervision.

Some Essentials in Teaching Farm Shop Work, by F. T. Struck.—The author holds that farm shop work should be placed absolutely on a project, as distinguished from an exercise, basis. Projects undertaken should not be limited to such as can be carried on within the school building or plant, but teachers should often take their classes "out on the job." There the boys may get first-hand experiences with concrete, wood, and other materials under conditions quite different from those that exist within the school building.

Farm Shop Work for High Schools, by L. M. Roehl.—The author discusses the content of farm shop courses for schools in accordance with the following definition of this subject: "Farm shop work shall consist of teaching the farm boys how to do the ordinary repair and construction work which arises on the farm with such tools and equipment as the average farmer may reasonably be expected to have."

Farm Shop Work, by E. W. Lehmann.—The author classifies farm shop projects, outlines the subject matter, and describes a project in the study of equipment, operation, and cost of filling a silo, carried out by a group of high-school students at Columbia, Mo.

Standards in Project Work, by H. L. Kent.—This paper is based on the replies to a questionnaire sent to supervisors, teachers, and teacher-training agents

There appears to be a general agreement that the productive project is the one which should be emphasized, with minor attention given to improvement projects. The objectives of a project, its planning, the time of its selection and the beginning of work, the relation of the project to the general class work, the setting up of definite minimum standards, the determination of the fitness of the project, the project on a commercial basis, the substitution of other work for the project, uniformity in project reports, and measuring the success of the project are briefly considered.

Nature and Character of Practical Work Other Than Home Project Work, by I. B. Ball.—An account is given of the supervision of home project work in Utah, which includes the project on a commercial basis; all general farm operations in which the boy engages; farm crafts, which are employed in all this work; farm mechanics achievements or minor projects; nature observations; club recreation, tours, hikes, fairs, etc.; community service; and health habits.

Mention may also be made of the following reports and addresses: A Forecast for Vocational Education, by C. A. Prosser; Some National Problems, by L. S. Hawkins; Future Problems in the Administration of Vocational Agriculture, by G. A. Works; Future Administrative Problems in Home Economics Education, by A. E. Richardson; and State Problems of Administering Vocational Education, by E. R. Snyder.

Agricultural instruction and investigation, A. MITSCHERLICH (*Illus. Landw. Ztg., 39 (1919), No. 79–80, pp. 401, 402*).—This is a discussion of the question of whether agricultural instruction in Germany can be given to better advantage in agricultural high schools or in university agricultural institutes.

In the author's opinion agriculture will be best served through the decentralization of agricultural education and research, which can be brought about only through the development or expansion of existing university agricultural institutes. The transformation of the Agricultural High School of Berlin and the Agricultural Academy of Bonn-Poppelsdorf into university faculties, including efficient training in the natural sciences, is thought to offer the best means of standardizing higher agricultural instruction. As a solution of the difficulties in the way of standardization, the author suggests a plan of cooperation between the Ministry of Agriculture, which controls the agricultural high schools, and the Ministry of Religion and Public Instruction, on which are dependent the university agricultural institutes, by which all matters pertaining to pedagogics and to the personnel, both in instruction and investigation, be referred to the Minister of Religion and Public Instruction, and all material affairs, such as the administration of experimental areas, the provision of adequate funds for agricultural research institutions, etc., be placed under the authority of the Minister of Agriculture.

Agricultural botany: Theoretical and practical, J. PERCIVAL (*London: Duckworth & Co., 5. ed., rev. and enl., pp. XIV+839, figs. 266*).—This is intended as a textbook adapted to the needs of students of agriculture.

[Plant and animal production], P. W. CHAPMAN (*Missouri Vocat. Ed. Buls. 6 (1920), pp. 44; 7, pp. 60*).—These two bulletins outline a year's work in plant and animal production, respectively. The bulletin on plant production indicates subject matter for recitation and classroom work, and exercises, arranged by seasons, for field and laboratory work in the study of corn, wheat, oats, forage crops, and soil physics and fertility. Exercises in related science are also included, this work being divided into two parts, namely, the science related to crops and the science related to soils. It should be given parallel to the work in crops and soils.

The bulletin on animal production is similarly arranged for the study of pork, beef, sheep, horse and mule, and poultry production, dairy farming, and related science.

A system of field and office records for county extension workers, M. C. Wilson (*U. S. Dept. Agr., Dept. Circ. 107 (1920), pp. 13, figs. 7*).—The system of records outlined is based upon a careful study of record systems actually in use by county extension workers in the 33 Northern and Western States in 1919, and is easily adapted to an office with no clerical assistance. It provides for a record of visits, calls, and meetings, and for files of follow-up work, permanent record slips, community work and projects, letters, bulletins, prints and negatives, etc.

MISCELLANEOUS.

The work of the Umatilla Reclamation Project Experiment Farm in 1918 and 1919, H. K. Dean (*U. S. Dept. Agr., Dept. Circ. 110 (1920), pp. 24, figs. 7*).—This report includes a summary of meteorological observations from 1912 to 1919, noted on page 122, a review of climatic and agricultural conditions on the project, located in northeastern Oregon, and a report of the work on the experimental farm during 1918 and 1919. The experimental work reported is for the most part abstracted elsewhere in this issue.

Biennial Report of Connecticut Storrs Station, 1918–19 (*Connecticut Storrs Sta. Rpt. 1918–19, pp. IX+190, figs. 30*).—This contains the organization list, a financial statement for the fiscal years ended June 30, 1918, and June 30, 1919, a report of the director, and reprints of Bulletins 100–104, previously noted. Meteorological data, noted on page 122, are appended.

Abstracts of papers not included in bulletins, finances, meteorology, index (*Maine Sta. Bul. 284 (1919), pp. 283–312+XVI*).—This contains the organization list of the station; abstracts of five papers previously noted and five noted elsewhere in this issue; meteorological observations noted on page 122; a financial statement for the fiscal year ended June 30, 1919; an index to Bulletins 276–284, inclusive, which collectively constitute the thirty-fifth report of the station; and announcements as to the work, publications, and equipment of the station.

Quarterly bulletin of the Michigan Experiment Station, edited by R. S. Shaw and M. M. McCool (*Michigan Sta. Quart. Bul., 3 (1920), No. 1, pp. 33, figs. 9*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: More Legumes are Needed in Michigan, by M. M. McCool; Improvement of the Wool Clip, by G. A. Brown; Make Your Own Vinegar, by Z. N. Wyant; Silage for Summer Feeding, by J. E. Burnett; Hughes Annual Sweet Clover, Six New Varieties of Wheat, Time to Plant Rye, and Time to Plant Wheat, all by F. A. Spragg and E. E. Down; Selecting Seed for Next Year's Potato Crop, by H. C. Moore; Fall Work in the Garden, C. W. Wald; The Solubility of Soil Phosphorus, by C. H. Spurway, previously noted from Technical Bulletin 45 (E. S. R., 43, p. 124); and a List of Available Bulletins.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta., 5 (1920), Nos. 7, pp. 193–223, figs. 4; 8, pp. 225–240, figs. 2; 9, pp. 241–255, figs. 4*).—These numbers contain articles abstracted elsewhere in this issue, answers to questions submitted, and notes.

NOTES.

Alabama Canebrake Station.—The station has leased 80 acres of land for the growing of annual sweet clover with a view to encouraging better methods of growing and distributing the seed. Several hundred acres of this sweet clover will be grown in this section next year.

California University and Station.—George P. Gray, assistant professor of entomology and chemist in the insecticide laboratory, has resigned to become chief of the division of chemistry of the newly established State department of agriculture.

The American Farm Economic Association.—The eleventh annual meeting of this association, formerly the American Farm Management Association, was held in Washington, D. C., December 30 and 31, 1920, and January 1, 1921.

Dr. H. C. Taylor of the Office of Farm Management and Farm Economics, U. S. Department of Agriculture, delivered the president's address on The Adjustment of the Farm Business to Declining Price Levels. His suggestions as to what the farmer himself may do on his own farm to tide over the present period of declining price levels included the drastic curtailment of expenses, even to the extent of decreasing production if necessary, and the repair and continued use of old machinery unless prices of new equipment shall have decreased considerably by the time it is needed on the farm. He suggested also the adoption of a sliding scale of wages for farm labor based on the important farm products, and predicted the reduction of cash rents and the fairer sharing of profits and losses by land owners and tenants. Greater production on the farm for home consumption, the improvement of social life in the community, and cheapening of marketing processes were urged. In the latter instance it was said that with due caution farmers' cooperatives might well be launched and carried on successfully under present conditions. Protection in the home market for agricultural products either under a world or a national economy was deemed necessary.

In the Farm Labor Problem, by D. D. Lescohier, there were presented the similarities between rural and urban labor problems, and case studies similar to those conducted in the cities were urged for farm labor in certain areas. One such study made of the earnings of harvest laborers in western grain growing areas was briefly reported, clearly indicating the interruption in employment due to the lapse of time between the close of the harvest in the Kansas, Nebraska, and northwestern Missouri area and its reopening in the North Dakota, Minnesota, and Montana region with the consequent financial loss to workers. In the discussion which followed A. L. Barkman, of the United States Department of Labor, contributed statistics by nationalities of the immigration of agriculturists, the States into which they found their way, and the industries in which they are now employed. B. M. Stewart, national director of the Canadian Employment Service, outlined the means adopted for distributing farm labor westward with the progress of the Canadian grain harvest.

B. H. Hibbard presented a paper on Farm Tenancy, based mainly on data from the 1910 census and those available from the one of 1920. These showed changes and trends in amounts of tenancy, and indicated that in many areas more or less of equilibrium has been reached between farm-land values and the proportion of land rented.

In Tests of Farm Efficiency, by B. Hunter, the case was presented for taking percentage return on the investment as a test of efficiency. It was said that the dual function of the farm justifies charging it for family food and shelter, and crediting it with home-used products. A discussion of this paper was contributed to by W. J. Spillman and L. C. Gray.

A paper on the Economic and Legal Status of Collective Bargaining was read by C. Morrill, giving an historical survey and noting recent bills. A. Hobson presented the economic position of farmers' cooperative endeavor in the marketing system, maintaining that three marketing functions, namely, assembling at the shipping point, storing and warehousing, and manufacturing and processing, are, out of eight steps in the marketing system, the ones most efficiently performed by farmers' cooperatives. Sources of savings to members were outlined.

W. Y. Durand of the Federal Trade Commission in treating the subject The Packer and the Farmer advanced the idea of an open road into commerce for the farmers' products, urging for the future better systems of farm costs accounting, better understanding on the part of both farmer and packer of the other's costs and profits, improved methods of producing and marketing live stock, adequate market news service for farmers, and a steadier flow of animals to market with steadier prices throughout the year. The suggestion was offered that farmers' cooperatively owned and operated stockyards under contract to insure the packers' buying there might be advantageous.

Farm Management as Insurance for the Northern Great Plains of North Dakota, by C. E. Miller, touched upon land settlement, proper size of farms, and adaptation of cropping systems to this region. R. R. Spafford illustrated his presentation of the subject Crop Competition with numerous slides showing graphically the seasonal labor demands of competing crops in various regions in the United States. H. R. Tolley presented the Farm Power Problem, discussion of which was led by J. I. Falconer and G. M. Rommel. R. H. Wilcox under the subject of Beef Cattle Feeding Costs gave data on the relation of cattle feeding to the farm business, which were gathered in recent surveys in Indiana, Illinois, Iowa, Nebraska, and Missouri.

A. C. Miller of the Federal Reserve Board, in an address on The Relation of the Federal Reserve System to Farm Credit, directed attention to the service rendered to farmers in the removal by the board of restrictions on Federal Reserve Banks against the rediscounting of agricultural paper, and its willingness to rediscount the same even on six months' maturity. He urged the encouragement of numerous private agencies for sending agricultural products to Europe on credit.

N. C. Murray in Price Trends offered a statistical study of the rise and fall of prices of agricultural products, of recent average wages of labor in terms of prices of farms products and yields per acre, and other phases of present price trends.

The committee on teaching presented in part results of a questionnaire answered by about 46 institutions regarding their courses in farm economics. In general, the separation of subject matter from agronomy is said to be progressing, and a course in general economics is more and more becoming a prerequisite. Recommendations regarding credits, hours, order of courses, and place in the college course for farm economics were outlined.

The extension committee reported the distribution of farm account books, instruction given in summarizing and analyzing accounts, cost accounting, and keeping of enterprise records, and the arrangement of farm management exhibits.

W. F. Handschin, for the committee on experiment funds and work, reported recommendations agreed upon at the Springfield meeting of the Association of Land-Grant Colleges as to desired legislation.

The committee on terminology recommended statistical investigation of present usage before making further report. In this connection R. T. Ely urged the consistent use of the terms "tenancy" for the institution of renting land, and "tenancy" for the body of renters.

The following officers were elected: President, W. F. Handschin, vice-president, F. W. Peck, and secretary, J. I. Falconer.

American Society of Agricultural Engineers.—This society held its fourteenth annual meeting at Chicago on December 28, 29, and 30, 1920.

The president's address was given by F. N. G. Kranich, and was followed by a paper on Land Clearing with Dynamite, by A. L. Kline. This paper dealt with the general features of the subject, but brought out especially the difference between electrical and fuse blasting. Fuse blasting is the cheaper method and is better adapted to small stump blasting jobs, but is more dangerous, not so convenient, and not always so effective as electrical blasting, which is adapted to medium and large sized projects. For stump-removal operations, the 20 per cent ammonia dynamite is considered the most uniformly successful and economical explosive. Statistical data quoted in discussion showed that the average unskilled user of dynamite wastes approximately 60 per cent of the explosive in stumping operations. Empirical rules were given for determining the amount of explosive to use for each stump, based on its size, kind, age, and condition and surrounding conditions. It was brought out that it is impossible to estimate accurately the cost per acre of stumping operations owing to the widely varying conditions of stump land.

E. E. Parsonage discussed Wagon Standards, giving data on dimensions of wagons thought to be most uniformly adapted to different farming conditions. E. C. Mandenburg took up The Preservative Treatment of Timbers in Farm Structures, including a brief outline of methods and preservative materials, principally creosotes and bitumens.

A paper on Factors Influencing the Draft of Plows was given by E. V. Collins, based on studies conducted at the Iowa Experiment Station as a part of the plowing project in progress for several years. While on normal soil the average draft increased rather uniformly with depth and speed, the striking feature was developed that with uniform speed and depth the maximum draft is not necessarily imposed by the stubble and general-purpose plows with abrupt moldboards and the minimum draft by the breaker plows with long narrow moldboards. This development is directly opposed to previous theories on the subject and opens up an interesting and important line of research in the design of moldboard shapes. In this connection attention was called to the influence of lugs and angles on tractor wheels on the mechanical condition of the soil. It was brought out that the packing of the soil by tractor wheels and the loosening of the soil by lugs and angles may have considerable influence on the amount of draft and on the relation of draft to depth and speed. This work is being continued.

Part of the second day was devoted to a so-called educational program, the principal speaker being S. H. McCrory of the U. S. Bureau of Public Roads. His address emphasized the importance of cooperation between Federal, State, and private agencies in agricultural engineering work, and announced the desire of his Bureau to cooperate with the State colleges and experiment stations in both research and teaching. This constructive attitude aroused considerable interest, and a committee on cooperation was appointed, consisting

of representatives from several State experiment stations and the Chief of the Agricultural Engineering Division of the Bureau of Public Roads.

Bearing closely on this matter was the report of the research and data committee, presented by R. W. Trullinger of the States Relations Service. This report summarized the status of research in agricultural engineering, and brought out that in most of the agricultural engineering work at the State colleges and experiment stations little attention has been given to the establishment of basic agricultural engineering principles, the practice being mainly to utilize available engineering knowledge in so far as it will meet the agricultural problems in hand. A great deal of the work has been done by agronomists and others not directly interested in the advancement of engineering knowledge, and there have also been many simple comparative tests of materials, machinery, or methods. The most comprehensive research thus far has been conducted on drainage, irrigation, materials, and farm structures, with the establishment of considerable basic engineering data, especially in the first three. Farm machinery, comprising the biggest field of agricultural engineering, has received the least research treatment and has perhaps been the subject of the most costly experimenting. Water supply, sewage disposal, and sanitation is another branch in which practically no research work has been conducted, but in which a great deal of popular teaching has been attempted without a knowledge of basic principles. The report recommended that research projects be established in all branches of agricultural engineering where the available knowledge does not meet requirements. In view of the movement for increase in station revenues, it was recommended that thoughtful attention be given to the formulation of research projects in agricultural engineering.

A list of some 500 references to agricultural engineering data, based on the results of research which had been selected from *Experiment Station Record*, accompanied the report. It was recommended that, in lieu of a data book, the research and data committee be authorized to print monthly a page of working data prepared from these and previous references in each issue of the journal of the society, in a form permitting its convenient removal and insertion in a loose-leaf data book.

The report of the committee on standards was presented by Raymond Olney. This included recommendations on various mechanical and engineering subjects, such as belt speeds, which have passed the prescribed year of use. The striking feature of the report, however, was the recommendation that all of the standing technical committees of the society be combined as subcommittees into two main committees on standards and research, and that the executive council of five be extended to include the officers of the society, with the president as chairman. These recommendations were taken under advisement by the executive council.

F. W. Ives of the Ohio Experiment Station presented a paper on Psychological Tests for Technical Efficiency in Agricultural Engineering. This was based on studies at the Ohio State University, conducted by Dr. H. E. Burtt, on the students and faculty members in agricultural engineering, the purpose being mainly to establish the basic principles of methods for determining whether or not a student is adapted to agricultural engineering as a profession. The results showed a striking degree of uniformity and accuracy in conforming to known facts, indicating that the ability of new students to pursue courses in agricultural engineering may be predetermined with a fair degree of accuracy.

A paper was presented by K. J. T. Ekblaw on Artificial Heating of Animal Shelters, based on an extensive study of the subject. It was held that the minimum temperature of animal shelters should be around 60° F.

O. W. Sjogren of the Nebraska Station described the methods and apparatus used in testing tractors in accordance with the Nebraska tractor inspection law. Tractor inspection in the State is apparently resulting in the stabilizing of tractor manufacture and sale, tending to eliminate unsatisfactory, fraudulent, and incomplete types.

An address by J. R. Howard on The Importance of Machinery as Related to Agriculture, dealt primarily with economic phases of the subject.

The third day was devoted entirely to the reports of technical committees. That on drainage was presented by S. H. McCrory of the Bureau of Public Roads, and summarized the results of questionnaire sent to 267 engineers in the eastern half of the United States, to determine average practice in the design, location, and construction of drainage structures. Of 100 engineers reporting, 52 used the Chezy-Kutter formula for computing the capacity of tile drains, 13 used Elliot's modification of Poncelet's formula, 12 used Poncelet's formula, and 8 used other formulas. In using the Chezy-Kutter formula, the value of the coefficient of roughness *n* varied from 0.011 to 0.017, the most commonly used values apparently being 0.013 and 0.015. The rates of run-off recommended for use in designing tile drainage systems varied with topography, soil, precipitation, etc., ranging from ⅛ in. under certain conditions, as used by 10 engineers, to ¼ in. as used by 58 engineers and ⅜, ½, ⅝, and 1 in. by others. A majority of the engineers reporting regarded the use of surface inlets desirable, and about half noted an increase of from 50 to 100 per cent in run-off by their use. A majority of the engineers regarded 5-in. tile as the minimum to be used for laterals together with a minimum grade of 0.1 per cent, although a number reported the use of less fall, and at least 0.2 per cent for laterals was deemed necessary in the Norfolk and Portsmouth series of soils in the South Atlantic States. As regards the depth and spacing of lateral drains in different soils, the depth averaged 3.51 ft. and the spacing 110 ft. on sandy clay, on silty clay 3.52 and 98 ft., on gravelly clay 3.62 and 114 ft., on clay 3.37 and 85 ft., on sand 3.78 and 150 ft., and on muck and peat 4.26 and 115 ft. The report as a whole brought out clearly the necessity for additional investigation on several factors affecting the design and construction of tile drains.

The report of the committee on tractors was presented by A. H. Gilbert. Certain recommendations were made regarding the use of lugs and angles on drive wheels, and it was recommended that a definite research project on this subject be initiated. Attention was also drawn to the importance of research in carburetion owing to the present low-grade fuels available.

The report of the committee on barn ventilation, presented by W. B. Clarkson, described the research work of the committee, some of which has been conducted in cooperation with the U. S. Department of Agriculture. A feature of this work was a study to determine the coefficient of heat losses through different walls.

Reports were also received from the committees on education and extension, publicity, membership, farm building equipment, belt and field machinery, stationary engines, sanitation, horses, roads, farm lighting, irrigation, and farm structures.

Officers for the ensuing year were elected as follows: President, E. A. White; vice-presidents, W. G. Kaiser and E. R. Jones; secretary-treasurer, F. P. Hanson of the Iowa State College; and members of the executive council, I. W. Dickerson, F. N. G. Kranich, Raymond Olney, F. A. Wirt and J. B. Davidson.

EXPERIMENT STATION RECORD.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The biochemistry of tobacco.—II, Tobacco seeds, G. PARIS (*Bol. Tec. [R. Ist. Sci. Sper. Tabacco, Scafati], 17 (1920), No. 1. pp. 101–115*).—In continuation of the investigation previously noted (E. S. R., 37, p. 509), a chemical examination is reported of tobacco seeds with a view to their practical utilization. The chemical composition of the entire seed is given as including water 9.17 per cent, crude protein 21.87, fat 37.68, amids and sugar 6.05, pentosans 2.9, cellulose 7.15, and ash 3.84. The ash contained SO_3 1.97 per cent, P_2O_5 22.12, Na_2O 3.48, K_2O 28.5, CaO 9.54, and MgO 14.63.

On expressing the oil from the seeds by means of an hydraulic press a hard compact press cake, pulverizing with difficulty, was obtained of the following composition: Water 11.83 per cent, crude protein 28.63, fat 1.64, nonnitrogenous extractives 31.41, cellulose 19.9, and ash 6.5. Attention is called to the similarity in composition of this press cake, except for its lower content in fat, to the press cakes of tomato and flax seeds. It is thought to be suitable as a feeding stuff or a fertilizer.

The oil from tobacco seeds was of a light yellow color with practically no odor. The constants of a sample of oil obtained from Kentucky tobacco seed were as follows: Specific gravity (15° C.) 0.9408, temperature of solidification 12°, acid number 4, saponification number 196, iodin number 132.8, and ether number 192. The oil consisted of about 52.4 per cent of olein, 22.1 of linolein, and 28.9 of palmitin. The oil is recommended as a drying oil as a substitute for linseed oil.

Further study of the tobacco seeds consisted of an investigation as to the presence of nicotin and the nature of the nitrogenous constituents. No nicotin was found except in slight quantities in the germinating seed. The dry seed, from which the fat had been removed, was found to contain 6.5 per cent total nitrogen, 3.76 protein nitrogen, 2.39 nuclein nitrogen, and 0.35 nonprotein nitrogen. Further examination showed the nitrogenous constituents to include proteins soluble in water, in 10 per cent NaCl, and in 0.5 per cent KOH. The presence of arginin was determined.

Oxalic acid in sugar cane and the composition of cane wax, J. E. Q. BOSZ (*Meded. Proefsta. Java-Suikerindus., Landbouwk. Ser., No. 5 (1920), pp. 9; Arch. Suikerindus. Nederland. Indië, 28 (1920), No. 25, pp. 969–977*).—Two studies are reported.

I. *Oxalic acid in sugar cane.*—The literature on the occurrence of oxalic acid in sugar cane is reviewed, and the results are reported of its determina-

tion in freshly-cut sugar cane. A 1 per cent hydrochloric acid extract of the sap yielded 0.01356 per cent of oxalic acid, while a water extract treated in the same way yielded only 0.00045 per cent, thus indicating that the oxalic acid in the sugar is present almost entirely in the form of compounds insoluble in water.

II. *The constituents of cane wax.*—A sample of sugar cane wax was found to have a melting point of 60 to 62° C., an acid number of 47.3, a saponification number of 177, and a content of 0.1 per cent of nitrogen. Cholesterin-like substances were not identified in the wax. Myristic and caproic acids were found to be present, but acetic, benzoic, and cinnamic acids were not found.

On the mucilaginous substance of Florideæ, E. Takahashi (*Jour. Col. Agr. Hokkaido Imp. Univ., 8 (1920), No. 6, pp. 183–232*).—Proximate analyses of three species of Florideæ, *Chondrus elatus, Gloiopeltis furcata,* and *Iridæa laminarioides,* are reported, together with a study of the hydrolysis products of the mucilaginous products obtained from these algæ by three extractions with boiling water.

The greater part of the mucilaginous substances is converted into sugars by hydrolysis. From the hydrolysis products of the Chondrus, galactose, arabinose, and an unknown sugar similar to galactose (named by the author floridose) were isolated. Small amounts of glucose, fructose, and mannose were also detected.

From the hydrolysis products of the Gloiopeltis, galactose, arabinose, and fucose were isolated, and glucose and fructose in traces, but floridose was not obtained. From the hydrolysis products of the Iridæa, galactose, arabinose, and floridose were isolated, glucose was thought to be present, but fructose was not identified. The author concludes that the important components of the mucilaginous substances of these algæ are galactan, araban, and the anhydrid of floridose.

The calibration, accuracy, and use of gas meters, A. Krogh (*Biochem. Jour., 14 (1920), No. 3–4, pp. 282–289, figs. 2*).—This paper consists of a description of a large recording spirometer for calibrating gas meters and a discussion of the relative merits of wet and dry gas meters.

A gas analysis apparatus accurate to 0.001 per cent mainly designed for respiratory exchange work, A. Krogh (*Biochem. Jour., 14 (1920), No. 3–4, pp. 267–281, figs. 4*).—A modified Jaquet apparatus which is said to be accurate to 0.001 per cent is described and illustrated.

The improvements on the usual arrangements consist principally in the use of three separate gas burettes, of which one is employed exclusively for moving the air to and from the absorption pipettes, the second to measure the air before and after the absorption of CO_2, and the third to measure it after the absorption of O_2. A second improvement is an arrangement for raising and lowering the mercury in the burettes by means of air pressure instead of by raising and lowering a mercury reservoir. This obviates the use of rubber connections between the burettes and the reservoirs.

The technique of conducting an analysis with this apparatus is described, a series of examples is given showing the accuracy attained with it in respiratory exchange work, and special arrangements and precautions are outlined for the use of the apparatus for absolute determinations of oxygen and nitrogen.

The determination of ammoniacal, nitric, and organic nitrogen in complex substances with the gas volumetric method, P. Baldi (*Gior. Chim. Indus. ed Appl., 2 (1920), No. 7, pp. 376–378, fig. 1*).—The author proposes for the complete analysis of ammoniacal-nitrate soils a method consisting essentially of three determinations of ammonia by the hypobromite method, the first on a water solution of the sample, the second on a water solution of the

sample after reduction of the nitric nitrogen to ammonia, and the third, on the insoluble residue from the water extraction after Kjeldahl treatment. In the second determination the method employed for reducing the nitric nitrogen to ammonia is that described by Davisson and Parsons (E. S. R., 40, p. 711).

The determination of carbon dioxid in water-insoluble carbonates, C. S. Robinson (*Soil Sci., 10 (1920), No. 1, pp. 41–47, fig. 1*).—This contribution from the Michigan Experiment Station describes titrimetric and gasometric methods for the determination of carbon dioxid in such materials as limestones, marls, and soils.

The technique of the titrimetric method is essentially as follows: The sample is weighed into a tube of 20 to 25 mm. diameter which is placed in a 250 cc. suction flask containing an excess of N/10 $Ba(OH)_2$. The mouth of the flask is closed by a one-hole stopper holding a dropping funnel, the end of which projects into the tube containing the sample. The side arm of the flask is provided with a short piece of heavy-walled pressure tubing with a screw clamp. The flask is evacuated to a pressure of 50 mm. of mercury, after which the screw clamp is closed and N/HCl is allowed to enter the flask slowly through the dropping funnel. When decomposition of the carbonate is complete the flask is rotated for a few minutes to permit complete absorption of carbon dioxid, after which the screw clamp is opened and the stopper, funnel, and tube removed, the liquid adhering to the outside of the tube being washed back into the flask. The liquid in the flask is filtered through a Gooch crucible to separate the precipitated carbonate, and the excess $Ba(OH)_2$ is then titrated with N/10 HCl, with phenolphthalein as indicator. For the analysis of soils containing very little carbonate and thus necessitating the use of a large sample, the relative positions of alkali and sample are reversed, the sample being weighed directly into the flask, the standard alkali placed in the tube, and the acid admitted into the flask proper instead of the tube.

The gasometric method involves the use of a special apparatus consisting of a 10 cc. burette having the upper 2 cc. graduated in 0.02 cc. and the remaining 8 cc. in 0.05 cc. The upper end of the burette is closed by a three-way stopcock having one arm bent at an acute angle and the other sealed to a cup holding 5 to 10 cc. and graduated to 5 cc. in 0.5 cc. The lower end of the burette is sealed to a bulb of such a size that the whole apparatus will have a capacity of 50 cc. from the upper stopcock to another three-way stopcock at the base of the bulb. This connects with two parallel glass tubes, one of them being provided with a hollow-glass stopper set at right angles to the tube. These tubes are in turn connected with a third three-way stopcock, the lower outlet of which is joined by means of heavy-walled pressure tubing to a mercury leveling bulb. In practice the material to be analyzed is weighed directly into the hollow-glass stopper, or if larger amounts are necessary as in the case of soils, is weighed and transferred to the tube in which the stopper fits. By operating the stopcocks and the leveling bulb the apparatus is exhausted. A known amount of standard acid is let into the tube containing the sample, and after the action is over the gas in the burette is read and the volume corrected to standard conditions.

Analyses of various limestones, marls, and soils by the two methods are given and the relative merits of the methods discussed.

"The deciding factor in the selection of the method to be used is the magnesium content of the material under examination. For magnesium-free or low magnesium limestones the gasometric method is much to be preferred. As the magnesium content increases, the rate of decomposition decreases so that with some samples of dolomite several hours are required for the complete

decomposition of a 100 mg. sample. Under such circumstances the method of choice is, of course, the titrimetric one, since the cost of the apparatus required for running several determinations simultaneously is small in comparison with that needed for making a corresponding number with the gasometric method."

The estimation of carbon dioxid and fermentable sugars, A. SLATOR (*Jour. Soc. Chem. Indus., 39 (1920), No. 11, pp. 149T–151T, fig. 1*).—An apparatus which was devised originally to estimate the total CO_2 formed when sugars are fermented by yeast, but was subsequently found to be of general application in CO_2 determinations, is described and illustrated.

The apparatus consists of a distillation flask connected with a large trap, the upper exit tube of which is bent at an angle and fused to a vertical condenser set parallel with the flask and provided near the lower end of the exit tube with a stopcock connecting with suction. The exit tube is joined by thick-walled rubber tubing to a flask in which is placed the standard $Ba(OH)_2$ solution. The side neck of the distilling flask is connected by pressure tubing provided with a stopcock to a piece of glass tubing sealed to an ordinary test tube. In practice the substance to be analyzed is placed in this tube and dilute acid in the flask, or vice versa, the air is exhausted, and the solution heated if necessary to start the reaction. After the reaction is complete the excess $Ba(OH)_2$ in the turbid solution is titrated with standard acid, a correction of 0.15 cc. of N/10 solution being added to correct for errors due to suspended Ba CO_3.

Applications of the method to the analysis of drinking waters for carbonates and the estimation of sugars by fermentation are described.

Destructive distillation in vacuo and its application to the study of carbohydrates, A. PICTET (*Bul. Soc. Chim. France, 4. ser., 27 (1920), No. 15–16, pp. 641–656*).—This lecture, delivered before the Chemical Society of France, consists of a description of some of the results obtained in the author's laboratory in the destructive distillation of carbohydrates under reduced pressure. Some of these studies have been previously noted from another source (E. S. R., 40, p. 110).

Weight variation of package foods, H. RUNKEL (*U. S. Dept. Agr. Bul. 897 (1920), pp. 20, fig. 1*).—The weight variation of package foods has been studied by selecting specifications for a method of weighing to represent good commercial practice in packaging granular free-flowing products, calculating the maximum errors expected from these specifications, and comparing the calculated errors with the variations in weight obtained in the commercial application of the specified method.

The data presented include exact specifications selected as the result of a study of the commercial practice at 126 factories in 21 States; the maximum errors of good commercial practice as calculated by the use of the method of least squares, the Bureau of Standards tolerances on scales, and the specifications of good commercial practice; observed variations in tests with the specified methods; and a comparison of the results obtained in hand and automatic weighing. The data show that the calculated maximum errors represent a close approximation to the maximum variations of good commercial practice, and that in properly operated machines the errors fall within the calculated maximum errors of hand weighing.

Observations on the value of the official method for the preservation of milk samples by means of potassium dichromate, L. MAGNIER DE LA SOURCE (*Ann. Chim. Analyt., 2. ser., 2 (1920), No. 8, pp. 242–245*).—The author is of the opinion that the French official method prescribed for the preservation of

milk samples, i. e., the addition of a 0.2 gm. tablet of potassium dichromate to each 200 cc. sample of milk, leads in a number of cases to uncertain and erroneous results, partly due to incomplete solution of the tablet in the milk and partly to chemical changes in the various constituents of the milk, particularly the lactose.

The microorganisms persisting in milk after pasteurization; their rôle in the decomposition of hydrogen peroxid, M. FOUASSIER (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 5, pp. 327, 328*).—In continuation of the observations previously noted (E. S. R., 43, p. 206), evidence is presented that the microorganisms *Bacillus subtilis* and *Tyrothrix tenuis*, which resist pasteurization, are not only able to decompose hydrogen peroxid but hasten the development of the lactic ferments by furnishing them a more easily assimilable culture medium through the peptonizing action which they exert on the milk.

Feeding stuffs accidentally contaminated with castor bean meal, C. BRIOUX and M. GUERBET (*Ann. Falsif.*, *30* (*1920*), *No. 139–140, pp. 150–160, figs. 4*).—Attention is called to the possible contamination of such feeding stuffs as peanut press cake with castor bean meal, and microscopic and agglutination tests for its presence are described.

The microscopic method is said to give good results if the castor bean accidentally introduced is in the form of nondecorticated grains and if the feed cake examined does not contain too great a quantity of colored cellulosic débris capable of masking the fragments of castor bean hulls.

The agglutination method described is similar to the Kobert method previously noted (E. S. R., 30, p. 204), except that the ricin is concentrated by precipitation with ammonium sulphate instead of alcohol and that rabbits are used instead of guinea pigs or pigeons for furnishing the red blood cells for the agglutination tests. The method, the technique for which is described in detail, is said to permit the detection of 0.2 per cent of ricin in peanut press cake. Tests with other press cakes have indicated that those of cotton seed, palm seed, and copra have a tendency to hemolyze blood corpuscles. Soy bean press cake was found to furnish strong agglutinins, but since the soy bean macerated in salt solution gives a characteristic milky emulsion, this test can be used to distinguish between soy bean and castor bean meal.

The commercial examination of sulfonated oils, G. F. PICKERING (*Jour. Soc. Chem. Indus.*, *39* (*1920*), *No. 17, pp. 305T, 306T*).—Sources of error in the published methods for the analysis of sulfonated oils are mentioned, methods for routine analysis which obviate some of these errors are outlined, and tabulated results are given of the application of the modified methods to the analyses of several commercial varieties of sulfonated oils.

Application of sulfonated products of seed and fish oils, F. SCURTI and A. FUBINI (*Staz. Sper. Agr. Ital.*, *52* (*1919*), *No. 7–9, pp. 436–446*).—The authors suggest the utilization of sulfonated seed and fish oils as substitutes for sulfonated castor oil in the various industries in which the latter is used.

The production and utilization of corn oil in the United States, A. F. SIEVERS (*U. S. Dept. Agr. Bul. 904* (*1920*), *pp. 23, figs. 11*).—This bulletin deals mainly with the production of crude corn oil as a by-product in the corn milling industry. The dry milling process, used for making hominy products, such as grits, flakes, meal, flour, and hominy feeds, and the wet process, used in the manufacture of starch, glucose, and related products, are described in detail, since the methods of degerminating and consequently the nature of the germ material used for oil extraction differ in the two processes. Descriptions are also given of the methods employed for expelling the oil from the germs and

for handling and disposing of the crude oil, oil cake, and corn germs. The utilization of corn oil, the effect of color and condition of the corn on the yield and character of the oil, and the economics of corn oil production are discussed.

Tables are given of original data on the fat, moisture, and free fatty acid content of material produced in hominy mills and starch and glucose plants, estimates of the cost of producing corn oil, and a comparison of the revenue obtainable from the germs of 1 bu. of corn when disposed of as feed and when used for oil expelling in either starch or hominy mills. It is estimated that the net revenue for expelling the oil would be 23.67 cts. per bushel of corn from the wet process and 16.7 cts. for the dry process, the balance in favor of expelling as against disposal of germs for feed stock being 15.27 and 5.75 cts., respectively.

The bulletin closes with a brief description of methods employed in the production of edible corn oil and a discussion of the future of the corn oil industry. It is thought that the amount of corn oil used for edible purposes in the future will depend upon the quantity available rather than upon any question of its utility. It is pointed out that many bakers use cottonseed oil rather than corn oil on account of the fact that the latter is not always obtainable in sufficient quantities.

Sugar-cane juice clarification for sirup manufacture, J. K. Dale and C. S. Hudson (*U. S. Dept. Agr. Bul. 921 (1920), pp. 15*).—Following a brief description of the methods commonly employed in clarifying sugar-cane juices for sirup manufacture and a discussion of their disadvantages, a new method is described which is essentially the same as the procedure described by Zerban (E. S. R., 44, p. 14), consisting in the use of kieselguhr. The procedure, as developed in the present study, consists in heating the juice to a temperature just below boiling, mixing it with a small amount of kieselguhr, and pumping it through a filter press, after which, without further treatment, the filtered juice can be evaporated to sirup either in an open evaporator or under diminished pressure in a vacuum pan. With 11 lbs. of high grade kieselguhr the juice from 5 to 6 tons of cane can be filtered through an 18-in., 18 frame filter press in about 4 hours. The resulting press cake is said to be hard and firm and capable of being easily and thoroughly washed.

While requiring a larger outlay of capital and larger operating cost than the simple process of skimming and evaporating in open evaporators, the method is recommended as yielding a cleaner product of more uniform and better quality. The possibility is also suggested of combining this process with the use of vegetable decolorizing carbons, although it is pointed out that the sirup obtained in this way loses much of its characteristic so-called cane flavor.

The bacteriology of canning (*Kansas Sta. Rpt. 1919, p. 76*).—Bacteriological studies of a large number of cans of asparagus put up in the summer of 1918 by the division of home economics to represent as many as possible methods of processing and treatment showed that the addition of more than 1 per cent of salt or 0.05 per cent of acid decreased the time of processing necessary to prevent spoilage, but injured the flavor and palatability of the product. Good results were obtained with the following treatments: (1) Asparagus treated with 1 per cent salt and heated for, respectively, 3.25 hours on 1 day, 1.25 hours each day for 2 days, 0.5 hour twice each day for 3 days, 0.75 hour twice each day for 2 days, 1.25 hours two times in 1 day, 0.75 hour twice on 1 day and once on the second day, or 1.25 hours twice on 1 day and once on the second day; (2) asparagus treated with 0.5 per cent of acid and heated for, respectively, 2.25 hours on 1 day, 0.75 hour each day for 3 days, 1.25 hours each day for 2 days, 0.5 hour twice each day for 2 days, 1.25 hours two times

in 1 day, 0.75 hour twice on 1 day and once on the second day, or 1.25 hours twice on 1 day and once on the second day.

The percentage of spoilage due to different types of bacteria was as follows: Aerobes alone, 17.4 per cent; anaerobes alone, 51.3 per cent; and both aerobes and anaerobes, 31.3. It is pointed out that since all of these organisms are spore-forming, and many of them are anaerobes, they will be difficult to destroy by heat and proper sealing will not prevent their growth in the jars.

Storage of perishable fruits at freezing temperatures, W. V. Cruess, E. L. Overholser, and S. A. Bjarnason (*California Sta. Bul. 324 (1920), pp. 25-43*).—In this publication the authors review briefly previous work of Fulton (E. S. R., 19, p. 542) and of Darrow (E. S. R., 40, p. 838) in regard to methods of preserving small fruits in cold storage, and present the results of experiments in which fresh cherries, apricots, loganberries, strawberries, red raspberries, currants, and grape juice were subjected to different treatments before being placed in cold storage, and after several months in storage were examined for color, flavor, and texture and used in the preparation of various products such as jellies, jams, canned fruits, preserves, candied fruits, and ice cream.

It was found that while untreated fruits, kept at cold-storage temperatures of about 32° F., lost their flavor and spoiled after about three weeks, the same fruits if held in water or sirup at from 8 to 12° retained their flavor and color very well for at least a year. The best results were obtained by crushing the fruits with or without sugar and keeping them at a temperature of from 8 to 12°. Fresh grape juice stored at this temperature was found to have a much better flavor than pasteurized grape juice. It is suggested that former brewing plants are well equipped for undertaking the storage of soft fruits and fruit juices in this way, and that the storage of these fruits should form a profitable method of utilizing such equipment.

Turpentine: Its sources, properties, uses, transportation, and marketing, with recommended specifications, F. P. Veitch and V. E. Grotlisch (*U. S. Dept. Agr. Bul. 898 (1920), pp. 51, pls. 5, figs. 7*).—This is an extensive compilation of information on turpentine under the headings of sources, manufacture, chemical nature and properties, uses, transportation, calculation of capacity and outage of tanks, basis of sale, turpentine tables, effect of storage, adulteration, State laws governing transactions in turpentine, need for uniform specifications and methods of testing, recommended specifications for turpentine, and statistics.

The specifications for gum spirits and wood turpentine were prepared and recommended by the U. S. Interdepartmental Committee on Paint Specification Standardization.

METEOROLOGY.

Long-time temperature prediction, F. L. West (*Science, n. ser., 52 (1920), No. 1356, pp. 611, 612*).—Supplementing an article previously noted (E. S. R., 44, p. 120), the following equation is given as expressing the temperature T as a function of the time of the year t and the time of the day θ:

$$T=Ma+\frac{Ra}{2}\cos t+\frac{Rd}{2}\cos\theta.$$

"It is empirical and assumes that the annual march of the temperature can be represented by a simple cosine function, that the daily march can also be so represented, and that the daily range does not appreciably change with the season.

"The constants are readily obtained from the U. S. Weather Bureau for any desired locality. The first one, Ma, is simply the mean annual temperature of

the place in question, the second, Ra/2, is one-half of the range of the annual march, or the difference between the mean daily temperatures of the hottest and coldest days of the year, and the third constant, Rd/2, is one-half of the range of the daily march or the difference between the maximum and minimum temperatures for the day. Rd remains approximately constant for the United States, except for the arid west. . . . In this dry area the daily range is very approximately 15° F. in winter and 25° in summer. Assuming this range to vary as a cosine function, which it does very approximately, the equation for the arid west becomes through the addition of one more term

$$T=Ma+\frac{Ra}{2}\cos t+\frac{Rd}{2}\cos\theta+\frac{Vv}{4}\cos\theta\cos t."$$

It is pointed out that the equation "has practical value in such cases as the determination of early morning temperatures where heating to protect crops from frost is practiced, in calculating hourly values where thermograph records have not been taken, and for engineers engaged in laying concrete in determining the normal time in the spring and fall when freezing temperatures are experienced during working hours."

The Kalahari or thirstland redemption, E. H. L. SCHWARZ (*Cape Town [Africa]: T. Maskew Miller, pp. VI+163, pls. 18, figs. 7; rev. in Nature [London], 106 (1920), No. 2653, pp. 2, 3*).—This book deals more in detail with the cause and remedy of the progressive desiccation of Africa than is done in an article on the same subject previously noted (E. S. R., 40, p. 717). The theory advanced is that the main cause of the drying up of the interior of Africa has been the diversion of river courses and that a practicable remedy lies in the construction of barrages which will return these rivers to their original courses.

South Africa is described as "a high block of land with steep borders; from all sides the water that accumulates in the interior is pouring away through innumerable gaps in the hedge of the encircling coastal mountains. The central districts, too far from the sea to benefit by the moisture blown inland from the ocean, are becoming drained. We must turn off the taps. The evaporation is three times the rainfall, which means that the air is drawing on the soil to supply its own humidity, and is carrying away the dampness of the soil, without which the plants can not live, to fertilize other regions. On all hands South Africa is being wrung dry. The central lakes that used to exist, and of which the last dried up in 1820, are no longer there to supply the moisture for the air in the central districts, so that sea-borne moisture, which, if reinforced with a little from the air over the land, would result in rain, finds the air hot and dry, and the moisture is blown away and is lost to us."

The author maintains that "when the gaps are blocked up and the old Kalahari lakes are once more there to supply the air of South Africa with moisture, the old central river of the Kalahari will once more flow," and the rainfall will increase to such an extent that only the more important crops will need irrigation and destructive droughts will cease.

Frost in the United States, R. DEC. WARD (*Geogr. Rev., 7 (1919), No. 5, pp. 339–344, figs. 3*).—This is a critical discussion of frost maps of the United States, particularly those prepared by Reed for the Atlas of American Agriculture and previously noted (E. S. R., 40, p. 209).

Cloudiness in the United States, R. DEC. WARD (*Geogr. Rev., 9 (1920), No. 4, pp. 347–356, figs. 17*).—This article discusses the subject under the heads of cloudiness as a climatic element, cloudiness maps of the United States including a new map of mean annual cloudiness here published for the first time, mean annual cloudiness, seasonal and annual variations in cloudiness, and relation

of cloudiness to rainfall. The article is well illustrated with charts and diagram.

"The annual amounts of rainfall and of cloudiness show no fairly fixed ratio, as might at first thought be expected. In comparing the southern Great Plains and their relatively small amount of cloud with the cloudier and rainier Great Lakes region, cloudiness and rainfall may seem somewhat closely related. In going east from the northern Great Plains to the Great Lakes, on the other hand, the rainfall doubles while there is no correspondingly marked increase in the amount of cloud; and the northern Gulf province has about four times the rainfall of New Mexico, while the cloudiness in the former district is not even double that in the latter."

New monthly and seasonal rainfall maps of the United States, R. DeC. Ward (*Geogr. Rev., 9 (1920), No. 9 [10 (1920), No. 3]. pp. 173–181, figs. 4*).—This is a critical review of recent contributions to this subject.

The exposure of rain gauges, M. de C. S. Salter (*Brit. Assoc. Adv. Sci. Rpt., 87 (1919), pp. 439–444*).—This article discusses briefly standard gauges and over exposure and under exposure of gauges, the discussion being based largely upon the experience and observations of the British Rainfall Organization.

Montana precipitation charts (*Helena, Mont.: Dept. Agr. and Pub., 1919, pp. [2], pls. 14*).—These charts, compiled from data furnished by the Weather Bureau of the U. S. Department of Agriculture, show the precipitation during the growing season, April to August, for a series of years (10 to 40) at 40 different places in the State, up to and including 1919. A characteristic feature of the annual precipitation is the large percentage which normally occurs during the growing season. The precipitation during the growing season of 1919 was abnormally low. That of the three seasons, 1917–1919, was below the average.

Fifth report of the Committee for the Investigation of Atmospheric Pollution (*[Gt. Brit.] Met. Off., Advisory Com. Atmos. Pollution Rpt., 5 (1919), pp. 30, figs. 14*).—This report covers the year ended March 31, 1919, and follows the same lines and reports observations at practically the same places as reports previously noted (E. S. R., 41, p. 315).

The report deals especially with apparatus and methods of measurement. An improved standard gauge is described. The results, which include data for insoluble carbon and tar, soluble and insoluble ash, loss on ignition, total solids, sulphate, chlorin, and ammonia, are classified with reference to seasonal variation, summer and winter, and differences in city and country air. Variations with reference to rainfall are also discussed.

A special study was made during the year of the acidity of the air, the attempt being to separate the acidity which existed in the form of free gas and that which was held by the suspended matter of the air. The methods and apparatus devised for this experimental study are described in some detail. As a result of the investigations on this subject "it appears to be necessary to abandon the assumption that the air will be always acid, and to provide for the possibility of its being alkaline."

Atmospheric pollution, J. Owens (*Brit. Assoc. Adv. Sci. Rpt., 87 (1919), pp. 429–439; abs. in Chem. Abs., 14 (1920), No. 18, p. 2834*).—The work of the Advisory Committee on Atmospheric Pollution, as recorded in the first five annual reports of the committee, is briefly summarized and discussed. The composition of the atmospheric deposits is shown for four representative stations, Oldham, Sheffield, London, and Malvern, and a table is given showing total atmospheric impurities during summer and winter for 20 stations, including towns and open country, from 1914 to 1918, inclusive.

The data show that the annual deposits vary from 1.69 tons per square kilometer at Malvern, representing country air, to about 90 tons per square

kilometer at Rochdale, which is representative of industrial centers. In the latter case the deposits were slightly less in summer than in winter. The results indicate that "the soluble impurities tend to vary together and have a distinct relation to the amount of rainfall." The insoluble ash is the only constituent showing a tendency toward a summer maximum.

SOILS—FERTILIZERS.

Soil alkali, F. S. Harris (*New York: John Wiley & Sons, Inc., 1920, pp. XVI+258, figs. 34*).—This book is a text and reference work for students of soils and others interested in arid agriculture, and is based largely on the work of the author at the Utah Experiment Station. The following chapters are included, showing the logical arrangement and broad scope of the book: Geographical distribution, the origin of alkali, nature of alkali injury to the plant, toxic limits of alkali, native vegetation as an indicator of alkali, chemical methods of determining alkali, chemical equilibrium and antagonism, relation of alkali to physical conditions in the soil, relation of alkali to biological conditions in the soil, movement of soluble salts through the soil, methods of reclaiming alkali lands, practical drainage, crops for alkali land, alkali water for irrigation, and judging alkali land.

A list of references to works bearing on the subject is appended to each chapter, and, in the case of unavailable publications, references to abstracts in *Experiment Station Record.*

The distribution of titanium in soils and plants, Geilmann (*Jour. Landw., 68 (1920), No. 2, pp. 107–124*).—A method for the determination of titanium in soils is described and analyses of a number of samples of different soils are reported, from which it is concluded that titanium occurs rather generally in soils. The content of titanium oxid varied from traces to 1 per cent, and in general can be reckoned to vary from 0.3 to 0.6 per cent.

Analyses of plants showed the presence of titanium oxid in almost all cases, the content being greatest in the green parts of plants.

Soil colloids, P. Ehrenberg (*Die Bodenkolloide. Dresden and Leipzig; Theodor Steinkopff, 1918, 2. ed., rev. and enl., pp. VIII+717, figs. 12*).—This is the second revised and enlarged edition of this book (E. S. R., 34, p. 515). It seems to have been largely rewritten, and the increase in size indicates the growth of the knowledge of the subject even during the war.

Studies on evaporation from different soils, E. Krüger (*Internatl. Mitt. Bodenk., 10 (1920), No. 1–2, pp. 1–13*).—Studies on the influence of a sand covering on evaporation from moor soils are reported, showing that in dry seasons the evaporation was less from the sand-covered soils than from those not sand covered. Rainfall reversed this situation. The difference in evaporation increased with the frequency of rainfall and decreased with the amount of rainfall. The amount of sand covering had only slight influence on the amount of evaporation.

Studies of evaporation from clay soil and coarse and fine sand soils showed that the percentage of the original water content evaporated was least from the clay soil and greatest from the fine sand. When saturated, the evaporation was greater from clay soil than from a light loamy sand or pure coarse sand.

Soil survey of Fayette County, Ala., A. M. O'Neal, Jr., et al. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 40, fig. 1, map 1*).—This survey, made in cooperation with the State of Alabama, deals with the soils of an area of 396,800 acres lying partly within the Appalachian Mountain and Plateau and Coastal Plain provinces in northwestern Alabama. The topography ranges

from almost level or rolling to strongly rolling or mountainous. The drainage is usually good.

The soils are of residual, sedimentary, and alluvial origin. Including rough broken land, 18 soil types of 9 series are mapped, of which the Ruston fine sandy loam, Hanceville silt loam, and Ruston sandy loam cover 30.3, 14.4, and 11 per cent of the area, respectively.

Soil survey of St. Clair County, Ala., R. T. A. BURKE and N. E. BELL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 46, fig. 1, map 1*).—This survey, made in cooperation with the State of Alabama, deals with the soils of an area of 405,120 acres lying in the Appalachian Mountain region in north-central Alabama, which topographically consists of mountains, ridges, and narrow and broad lowland belts. The area is well drained with the exception of the stream bottoms and some of the flatter upland areas.

The soils are of residual and alluvial origin. Including rough stony land, 30 soil types of 15 series are mapped, of which the Hanceville stony loam is the most extensive type.

Soil survey of Lowndes County, Ga., D. D. LONG and N. M. KIRK (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp 36, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 332,800 acres lying within the Coastal Plain province in extreme southern Georgia. The surface features comprise gently rolling uplands, flatwoods, an undulating to strongly rolling section, and large swampy alluvial belts. The drainage conditions range from very good to poor.

The soils are of residual and alluvial origin. Including swamp, 19 soil types of 9 series are mapped, of which the Norfolk fine sandy loam, swamp, and Leon fine sand cover 18.8, 13.2, and 11.5 per cent of the area, respectively.

Soil survey of Pierce County, Ga., E. T. MAXON and N. M. KIRK (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 29, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 324,480 acres lying entirely within the Coastal Plain province in southeastern Georgia. The area is a flat, featureless plain characterized by sections of loose sandy soils and poor drainage.

The soils are of sedimentary and alluvial origin. Including 16.4 per cent of swamp, 18 soil types of 8 series are mapped, of which the Plummer sand covers 22 per cent of the area. The Norfolk series is the most important agriculturally.

Soil survey of Nez Perce and Lewis Counties, Idaho, J. H. AGEE and P. P. PETERSON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 37, pls. 3, figs. 2, map 1*).—This survey, made in cooperation with the Idaho Experiment Station, deals with the soils of an area of 639,040 acres in the west-central part of the northern extension of Idaho. The area consists mainly of gently sloping plateaus traversed by deeply cut stream canyons.

The soils are of residual, loessial, and old and recent alluvial origin. Including rough stony land, rough mountainous land, and riverwash, 14 soil types of 9 series are mapped, of which rough stony land and rough mountainous land cover 23.3 and 19.4 per cent of the area, respectively. Of the classified types the Palouse silt loam, Nez Perce silt loam, and Southwick silty clay loam are the most extensive, covering 16.4, 11.9, and 11.5 per cent of the area, respectively.

Soil survey of Chenango County, N. Y., E. T. MAXON and W. SELTZER (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 37, fig. 1, map 1*).—This survey, made in cooperation with the New York State College of Agriculture, deals with the soils of an area of 572,160 acres lying along the northern border

of the Allegheny Plateau in south-central New York. The surface varies from rolling to hilly. The area is well drained, except in some parts of the valleys.

The soils are mainly of glacial origin. Including meadow and muck, 22 soil types of 11 series are mapped, of which the Lordstown, Wooster, and Volusia silt loams cover 28.3, 19.6, and 14.2 per cent of the area, respectively.

Soil survey of Bertie County, N. C., R. C. JURNEY and S. O. PERKINS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 34, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 436,480 acres lying almost entirely in the flatwoods section of the Coastal Plain province in northeastern North Carolina. The topography ranges from flat to gently rolling or rolling, and the drainage is inadequate.

The soils are of residual and alluvial origin, and their texture is prevailingly fine. Including swamp, 22 soil types of 12 series are mapped, of which swamp covers 15.5, Coxville silt loam 15.2, and Dunbar very fine sandy loam 14.9 per cent of the area, respectively.

Origin and properties of red soils, W. GRAF ZU LEININGEN (*Internatl. Mitt. Boden., 7 (1917), Nos. 1–2, pp. 39–65; 3–4, pp. 176–204*).—A summary of the results of work by others bearing on the subject is given, together with a report on studies of the origin, geology, and physical, biological, and chemical properties of the red soils of the Mediterranean region.

These red soils are considered to be the weathered residues of impure limestones, and on this basis are described as a mixture of free colloidal iron and aluminum hydroxids and different amounts of clay. Alkalis, especially lime and magnesia, are present only in small amounts and are considered as red soil impurities. These red soils were found to be highly plastic, tough, and sticky and to swell on becoming moist and shrink on drying out. When heated they became darker in color and burned to a hard glaze.

It was found that sedimentation analyses did not give an exact and constant indication of the mechanical composition of red soil, owing to the flocculating action of distilled water. Such analyses indicated, however, that particles of sizes from 0.006 mm. upward have an entirely different color from that of the finest particles. The particles less than 0.02 mm. size consisted mainly of fine mica leaves, and the greater the particles the more evident it was that they consisted of unweathered material.

Studies of the chemical properties of these soils showed that in general they redden blue litmus paper and have the power to absorb iron and ammonia solutions. It is noted that the absorbed ammonia is firmly combined and is not entirely given off after lying for a week in the open air. Red soils containing some humus were found to contain nitrifying, denitrifying, and sulphur-transforming bacteria, while those practically free from humus were practically free from bacteria.

Chemical analyses of red soils from several localities are included, showing that these soils are closely related to laterite in composition. A bibliography is appended.

Soil studies in the needle forest region of northern Sweden, O. TAMM (*Meddel. Stat. Skogsförsöksanst., 17 (1920), No. 3, pp. 49–300, pls. 4, figs. 22*).—The results of eight years' field studies on the physical and chemical properties of the different podsol soils of the forest regions of northern Sweden are reported.

The original strata of the soils of the region in general show the effects of a complete weathering as indicated by studies of their clay constituents. All of the coarser strata have a very uniform granitic composition, which is influenced only slightly by the size of grains. It is concluded that, in general,

mechanical and physical processes have had little influence in the formation of these podsols.

The formation of ortstein is also discussed at length. It was found that the forest soils of the region are well supplied with minerals containing nutritive constituents. The lime content, however, occurs largely in insoluble forms, and where it occurs as carbonate is rapidly leached out. The formation of bleich erde in these soils has tended to impoverish them. The bleich erde formations are almost free from colloidal matter and therefore poor in adsorbed nutritive constituents. The occurrence of apatite is apparently of importance, owing to its content of phosphoric acid and soluble lime.

It is concluded that podsol and ortstein formations are of no great significance from the forestry standpoint, and that the problem of improvement of the pine forest soils lies mainly in the treatment of the so-called humus strata. On the other hand, improvement of pine heather soils depends not only upon the treatment of the humus strata but also upon the maintenance of moisture conditions in the surface soil.

Variation of composition of adjacent soils, G. VERNET (*Bul. Agr. Inst. Sci. Saigon [Cochin China], 2 (1920), No. 9, pp. 263–268*).—Analyses of eight samples of soil taken from within a radius of 100 meters in a rice field showed marked variations in physical and chemical properties, caused by the slope and close proximity to a stream. Similar variations in physical and chemical properties were also found in other soils growing different crops.

Conservation of the soil (*Kansas Sta. Rpt. 1919, pp. 14–23*).—Progress data from a number of soil conservation projects at the station are reported.

The results of crop rotation experiments indicate the general influence of different fertilizers on corn, wheat, and alfalfa.

The investigation of the effect of prolonged production of alfalfa upon soil fertility was continued (E. S. R., 42, p. 425) showing that the most significant changes are confined to the first 7 in. or surface soil.

In the subhumid section the cropped soils contained 26 per cent less carbon than the soils in native sod and the alfalfa soils 17 per cent more carbon than the soils continuously cropped, but 10 per cent less than the soils in native sod. In the semiarid section the cropped soils contained 30 per cent less carbon than the soil in native sod and the alfalfa soils 23 per cent more carbon than the cropped soil, but 9 per cent less than the soil in native sod. Nothing was found to indicate that the growing of alfalfa has changed the carbon content of these soils.

In studies on the influence of absolute reaction of the soil solution upon Azotobacter it was found that approximately 40 per cent of the soils examined failed to show the presence of the Azotobacter group of organisms and possessed a correspondingly low nitrogen-fixing ability. The presence or absence of Azotobacter appeared to be correlated with the absolute reaction of the soil solution. As far as examined, those soils from which the aqueous extract showed a H-ion concentration greater than 1×10^{-6} did not contain Azotobacter, while those with a less concentrated H-ion extract contained Azotobacter. The degree of acidity tolerated by pure cultures of Azotobacter appeared to be a H-ion concentration of approximately 1×10^{-6}. Field and laboratory experiments showed that when an excess of calcium carbonate was added to a soil, the acidity of which was too great for the growth of Azotobacter, and at the same time the soil was inoculated with this group of organisms, a vigorous Azotobacter flora was established. The addition of lime without the addition of the organisms was without effect in the laboratory. Under field conditions where the organisms exist in the immediate vicinity the artificial addition of the organisms in order to establish an Azotobacter flora appeared to be unneces-

sary. The quantity of inoculum necessary to establish an Azotobacter flora in a soil rendered alkaline with calcium carbonate was very small.

Tillage investigations showed the importance of early summer seed-bed preparation for wheat, and indicate the possibility of economizing on the depth of plowing by the practice of a rotation. In cropping wheat continuously, July plowing 6 to 7 in. deep produced the greatest yield. August plowing reduced the yield about 1 bu. per acre. Disking in July and plowing in September only reduced the yield a little less than 3 bu. per acre, while plowing in September without the July disking reduced the yield 8½ bu. Early plowing is considered preferable to early listing, but early listing is preferable to September plowing without disking in July.

Nitrification was found to be as active in a bare soil with weeds removed as in a soil cultivated 6 in. deep. There was little difference between the moisture contents of the two soils. Moisture did not appear to be a determining factor in nitrification.

Parcel size experiments, W. SCHNEIDEWIND, D. MEYER, and F. MÜNTER (*Arb. Deut. Landw. Gesell., No. 296 (1919), pp. 51*).—Investigations on the usefulness of different sizes and arrangements of plats in fertilizer experiments and their influence on the theory of probability are reported. Plats of 200, 100, and 9 square meters in area were used, with and without untreated bare plats between them. The crops were sugar beets for two years, summer wheat for two years, and winter rye for one year. Sodium nitrate was used in varying amounts for fertilizer.

It was found that the plats having untreated bare plats 80 cm. broad between them were not suitable for fertilizer tests, since they produced too high a yield and did not properly indicate the effect of fertilization. The yields from the different sized plats which bordered on each other corresponded rather closely when estimated on the acre basis, especially where fertilization was relatively heavy. Where fertilizers were so applied as to be limited in distribution by the last drill row of a plat, no noteworthy influence of such fertilization was exercised on neighboring plats. The difference between the highest and lowest individual yields reckoned on the acre basis were greater the smaller the plats. While, according to the theory of probability, the increased yields obtained by fertilization were quite uniform from plats of one size, there was not sufficient correspondence in the increased yields obtained from plats of different sizes.

Demonstration fertilization: Statistical and exact field fertilization experiments, 1903–1918, M. HOFFMANN (*Arb. Deut. Landw. Gesell., No. 299 (1919), pp. VIII+279, pls. 4*).—This is an extensive report of a large number of experiments designed to demonstrate the normal action of artificial fertilizers in crop production and the rational utilization of artificial fertilizers, potash in particular, on German soils. It is apparently a direct educational effort to promote the use of artificial fertilizers as a means for increasing food production.

Basis for meadow fertilization according to results of long time experiments, AHR and C. MAYR (*Freising [Germany]: Dr. F. P. Datterer & Co., 1919, pp. [2]+159*).—Five years' fertilizer experiments on seven different meadows are reported, the purpose of which was to establish a rational basis for meadow fertilization.

The experiments included studies of the action of potash and phosphoric acid alone and in combination, the relative action of different nitrogenous fertilizers, the relative value of phonolite and potash salts with and without different nitrogenous fertilizers, the value of early, medium early, and late

fertilization with phosphoric acid and potash, and the residual action of the fertilizers used. Apparently the main feature of the results obtained was the importance of potash fertilization for meadow soil, which was always greater than that of phosphoric acid fertilization. Phonolite was found to be an effective potash fertilizer for meadow. Nitrogen fertilizers generally had an uncertain effect on meadow soils, especially lime nitrogen and ammonium sulphate. Sodium nitrate gave the best and most uniform results. The nitrogenous fertilzers, in contrast to the potassic and phosphatic fertilizers, showed almost no residual action.

It is concluded that, owing to their strong fertilizing action on meadow soils, potash and phosphoric acid should be the main additions in the treatment of such soils. As a basis for their use it is pointed out that a strong need for potash exists when the first cutting of hay shows a low potash content, but a high potash content in later cuttings shows the presence of plenty of potash in the soil. When later cuttings of grass show a phosphoric acid content of less than 0.65 per cent, the deficiency in phosphoric acid in the soil is considered to be greater than is indicated by a low content of phosphoric acid in the earlier cuttings and vice versa.

The determination of fertilizer requirements of the soil on the basis of a botanical analysis of the hay crop is also discussed at some length.

Influence of time of liming on utilization of stable manure, S. Rhodin (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 200* (*1920*), *pp. 17*).—Experiments with ten different representative Swedish soils to determine the influence of the time of liming on the utilization of stable manure by wheat, rye, barley, and beets are reported.

Soils treated with stable manure were limed in late spring or late summer. Analyses of 285 samples of these soils showed that liming did not in general increase the nitrate content of manured soils and that time of liming had apparently little influence. The crop yields showed the same results.

Fertilizer experiments with urine.—Stimulating action of copper and mercury compounds, O. Nolte (*Fühling's Landw. Ztg., 69* (*1920*), *No. 7–8, pp. 141–144*).—Experiments with mustard on sand soil to compare ammonium sulphate, urine, urine absorbed in so-called humus carbon, urine treated with copper, and urine treated with a copper and mercury compound showed that, with the exception of the ammonium sulphate, the urine treated with copper and mercury gave the best results both as regards total harvest and nitrogen utilization. The urine conserved with humus carbon gave better results than plain urine. The experiments are to be continued and extended.

The nitrogen in sewage, G. McGowan (*Surveyor and Munic. and County Engin., 57* (*1920*), *No. 1477, pp. 405–407*).—This paper summarizes the sewage-nitrogen situation in England and Ireland, it being shown that of the nitrogen in human excrement approximately 94 per cent is present in the urine and the remainder in the feces. In England this nitrogen is estimated to amount to almost nine times the quantity used in the form of ammonium sulphate and sodium nitrate for agricultural purposes before the war, or to about four times the present use. Only a comparatively small portion of such nitrogen is at present returned to the soil, and that consists mainly of the more unavailable compounds.

An appendix by M. Flack is included on the nitrogen in the excreta of human beings, it being concluded that an average excretion of 2 gm. per person per day for the entire population is a fair allowance.

Peat in 1919, K. W. Cottrell (*U. S. Geol. Survey, Min. Resources U. S., 1919, pt. 2, pp.* [*I*]+*41–46*).—This report contains data on the production and use of peat in the United States during 1919.

The total production during the year was 69,197 short tons, valued at $705,532. This was a decrease of 35 per cent in quantity and of 33 per cent in total value, but an increase of 44 cts. in price per ton, as compared with 1918.

In 1919 almost the entire output of peat was used as a direct fertilizer and for a nitrogenous ingredient of commercial fertilizers. The total shipment of peat for this purpose reported from 13 plants was 54,690 tons, valued at $557,240. This was 31 per cent less in quantity and 28 per cent less in value than that reported in 1918. Peat was also used as fuel, stock food, and a source of alcohol.

A list of peat producers in the United States is included.

Ammonium sulphate nitrate, a new German nitrogenous fertilizer (*Bl. Zuckerrübenbau, 27 (1920), No. 9–10, pp. 82, 83, fig. 1*).—Ammonium sulphate nitrate is described, it being shown that it contains 27 per cent of nitrogen, 19 per cent as ammonia, and about 8 per cent as nitrate.

The direct synthetic ammonia process, R .S. Tour (*Jour. Indus. and Engin. Chem., 12 (1920), No. 9, pp. 844–852, figs. 7*).—This process, as used by the Nitrate Division, Ordnance Department, U. S. Army, is described and some data included.

The mechanism of the decomposition of cyanamid in the soil, G. A. Cowie (*Jour. Agr. Sci. [England], 10 (1920), No. 2, pp. 163–176, figs. 5*).—Experiments conducted at the Rothamsted Experimental Station on soil under natural conditions, using amounts of cyanamid comparable with those used in practice, are reported.

The results failed consistently to show any appreciable amount of ammonia from the decomposition of cyanamid in sterile soils. The addition of cyanamid to such soils was found to lead to an accumulation of urea, which persisted as such as a result of the suppression of the urea-decomposing organisms. The addition of cyanamid to soils heated to 100° C. did not lead to an immediate production of ammonia but yielded urea, which then decomposed into ammonia after the recovery of the appropriate organisms. On the other hand, there was a rapid and progressive production of ammonia arising from the decomposition of cyanamid in unheated normal clay and sandy soils.

It is concluded that cyanamid in the soil is normally converted by a purely chemical process into urea, and that this change is not dependent upon the activity of microorganisms. The urea is then broken down to ammonia by a change which the data indicate is produced by soil organisms. Such decomposition appeared to be more rapid in clay than in sandy soils, and did not occur in impure quartz sand, peat, or fen soils. The study did not reveal the exact nature of the decomposing agent in the soil.

Nitrogen of the cyanid group in fertilization, R. Perotti (*Atti. R. Accad. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat., e Nat., 29 (1920), V, No. 5, pp. 206–210*).—Studies are reported from which the conclusion is drawn that under suitable cultural conditions, particularly in the presence of a proper proportion of sources of energy, such as glucose, different forms of microorganisms can utilize the nitrogen of potassium cyanid in their nutrition, and that under ordinary conditions in soils such circumstances are easily obtainable.

Field experiments on the action of different nitrogenous fertilizers, P. Wagner (*Ber. Landw. Reichsamte Innern. No. 40 (1916), pp. VIII+136*).—This is a combined report of experiments conducted at seven German agricultural experiment stations, having a duration of from three to nine years, on the relative fertilizing value of the nitrogen in calcium nitrate, lime nitrogen, and liquid manure as compared with that in sodium nitrate and ammonium sulphate.

Of all the fertilizers used, sodium nitrate stood first in activity and in the utilization of its nitrogen. Calcium nitrate gave almost as good results as sodium nitrate. Ammonium salts gave results within from 7 to 8 per cent as good as those given by nitrates on potatoes and above-ground crops, while on beets they gave yield increases within 35 per cent of those given by nitrates and showed a nitrogen utilization within 25 per cent. The better results given by sodium nitrate with beets is attributed in part to its sodium content. On soils rich in lime and relatively poor in clay constituents, the maximum results were obtained with the ammonia nitrogen when the ammonium salts were mixed with superphosphate. Maximum results were in general obtained from the ammonium salts when they were used alone and applied to summer crops before seeding. A sufficient lime content of the soil was also necessary.

The results obtained with lime nitrogen were more uncertain than those with ammonium salts and were on the average not so good. The effectiveness of lime nitrogen reached 75 per cent of that of sodium nitrate for above-ground crops and only 57 per cent for beets. There was considerable nonuniformity in its action. It was best applied several weeks before the growth of winter crops, and it was found inadvisable to add it to snow covered or too damp soil. Best results were obtained when it was thoroughly incorporated in the soil.

Liquid manure gave practically as good average results as the ammonium salts. Better results were obtained with beets than with above-ground crops.

The United States' search for natural deposits of soluble potash, H. D. Ruhm (*Jour. Indus. and Engin. Chem., 12 (1920), No. 9, pp. 837–840, figs. 2*).—The author briefly reviews the history of the well-known natural deposits of soluble potash, particularly those in Germany, and apparently believing in the existence of similar deposits in the United States, urges that the Government investigate the potash resources of some of the eastern States where the potash can best be utilized.

Cooperative experiments for the composting of phosphate rock and sulphur, W. B. Ellett and W. G. Harris (*Soil Sci., 10 (1920), No. 4, pp. 315–325*).—Experiments conducted at the Virginia Experiment Station to determine the changes that take place when phosphate rock is composted with clay loam soil, sulphur, and manure are reported.

Four compost mixtures were studied as follows: (1) Soil, rock phosphate, and sulphur, (2) soil and rock phosphate, (3) soil, manure, rock phosphate, and sulphur, and (4) soil, manure, and rock phosphate. It was found that the addition of sulphur to a compost of soil and rock phosphate increased the availability of the phosphoric acid, but not to the same extent as when manure was added to a compost of soil, rock phosphate, and sulphur. In the second and fourth compost mixtures described above, without sulphur, there was no appreciable increase in the availability of the phosphoric acid.

Sulphur oxidation was found to precede the increase of available phosphoric acid. The addition of phosphate to manure slowed up the fermentation, and there was a loss of only 57.8 per cent of dry matter and 48.21 per cent of nitrogen in two years. At the same time there was an increase in nitrate nitrogen and a loss in ammoniacal nitrogen. The addition of sulphur and phosphate to manure checked the fermentation to a greater extent than the phosphate alone, there being a loss of only 43.77 per cent of dry matter and 46.44 per cent of nitrogen in two years. Here, however, the increase in ammoniacal nitrogen was balanced by the loss in the nitrate nitrogen. All the Virginia soils tested had some sulfofying power, but there was a very great variation

among the different soils. The majority of these soils oxidized less sulphur than was found by previous studies at the Kentucky and Iowa Stations.

The results obtained so far are not considered to justify the recommendation that Virginia farmers conduct experiments along similar lines, since the formation of available phosphoric acid is too slow to meet their needs.

The influence of initial reaction on the oxidation of sulphur and the formation of available phosphates, J. G. Lipman and J. S. Joffe (*Soil Sci., 10 (1920), No. 4, pp. 327–332, figs. 2*).—Studies conducted at the New Jersey Experiment Stations are reported which showed that there was no advantage in starting the composting of rock phosphate, soil, and sulphur with a relatively high hydrogen-ion concentration through additions of sulphuric acid. On the other hand, evidence was obtained that such advantage may be had in mixtures of a different composition. The data relative thereto are to be reported later

Methods of applying lime, J. A. Slipher (*Natl. Lime Assoc., Trade Bul. 105 (1920), pp. [4], figs. 2*).—Methods of incorporation of lime with soil are discussed.

The use of molasses as fertilizer on the island of Mauritius, P. de Sornay (*Bul. Assoc. Chim. Sucr. et Distill., 37 (1919), No. 6, pp. 223–234*).—The works of others bearing on the subject are summarized, and experiments on virgin and cultivated soils are reported. These showed that waste molasses from the sugar industry is a valuable nitrogenous and potassic fertilizer for the soils of the island. However, it is concluded that the effectiveness of molasses is not limited to the action of its fertility constituents, but includes other as yet undetermined factors. It was found to be particularly active in promoting the growth of young cane, and its general use for this purpose is recommended.

Carbonic acid gas to fertilize the air, A. Gradenwitz (*Sci. Amer., 123 (1920), No. 22, pp. 549, 557, figs. 3*).—A brief account is given of work by F. Riedel, at Essen-on-Ruhr, in using the purified gases from blast furnaces in greenhouses and plat experiments with various crops, including castor bean, tomatoes, cucumbers, spinach, potatoes, barley, and lupines. The air of the greenhouses was charged with the gases through perforated pipes. The air surrounding the plants grown in the open was supplied with the gases in a similar way. The purified gases contained 20 per cent of carbon dioxid. There was a marked increase of production, both in greenhouses and in the open, by the application of the gases and no injurious effects.

AGRICULTURAL BOTANY.

The evolution of plants, N. Bernard (*L'Evolution des Plantes. Paris: Libr. Félix Alcan, 1916, pp. XXXII+314, figs. 29*).—This book is one of the Nouvelle Collection Scientifique. After a preface by J. Costantin, the author deals, in the first part of the book, with the general laws and included facts of evolution; in the second, with the higher plants as regards morphology and systematization; and in the third, with certain hypotheses and special developmental facts and features.

Inheritance of sex in Mercurialis annua, C. Yampolsky (*Amer. Jour. Bot., 6 (1919), No. 10, pp. 410–442, pls. 4, fig. 1*).—This paper, following up that previously noted (E. R. S., 36, p. 522), deals with male, female, and monœcious cultures of *M. annua*.

While the results tend to bear out the well-known breeding law that "like tends to beget like" in case of sex as well as of other characteristics (males tending to produce males and females to produce females), the sporadic occur-

rence in varying numbers of flowers of the opposite sex on either form makes it appear that sex intergradation is an actual condition to be recognized in plants. The rather sporadic appearance of flowers of the opposite sex upon a plant points also to the fact that sex determination is not absolute.

The condition of sex intergradation points to the fact that a theory of sex inheritance which assumes fixed sex factors segregated at the time of the reduction division can not account for the production of sex intergrades. In a discussion of sex determination in plants in which alternation of generations regularly occurs, both generations should be borne in mind. An examination of the literature is said to bring out the fact that the sex of either one of the generations in cryptogamic and phanerogamic plants is not fixed. Results in inheritance of polygamous species tend to bear out the conception that in such forms gametes of graded potencies exist, this being true of the egg as well as of the male gamete. It is thought that this, together with the behavior of selfed females and males as in *M. annua*, may explain fluctuations in the expected 1:1 ratio.

The occurrence and inheritance of sex intergradation in plants, C. Yampolsky (*Amer. Jour. Bot., 7 (1920), No. 1, pp. 21–38*).—Having, in the paper above noted, called attention to sex intergradation in *Mercurialis annua* in both male and female cultures, the author draws largely upon the same material for the discussion here given of the general question of sex intergrades as they occur in flowering plants.

It is regarded as certain that sex in Mercurialis is a fluctuating rather than a fixed character, expressing itself in a wide range of sex intergrades, and including as extremes some pure male and some pure female plants and midway between the extremes highly fertile monœcious forms. The sex intergrades here are all highly and equally fertile, and no suspicion of abnormality or of pathological conditions can attach to them. That there is a tendency to pure diœcism seems highly probable, but the transition from hermaphroditism is still represented by all possible gradations, showing most convincingly that theories of sex determination based on the segregation of fixed unit factors can have no significance for such types.

Male cultures of *M. annua*, while they do not show the tendency toward intergradations as often as do the females, nevertheless bring out very clearly sex gradations in sex potency. In Mercurialis, though the species is prevailingly diœcious, it is assumed that the potentialities for the development of both sexes are present in practically all the individuals of the species, evidence nowhere appearing that sex is determined in this plant by the presence or absence of a sex-determining factor. Individuals which remain purely male or purely female throughout are not to be conceived as very different from those which produce a few flowers of the opposite sex.

No evidence is offered regarding the localization of the sex difference either in a special part of the plant or in a special part of the cell. Sporadic flowers of the other sex may occur anywhere on the plant and at any stage of its development, their occurrence being comparable to that of bud variation and showing supposedly that the organism may contain latent potentialities as well as visibly expressed characters. The production of a few flowers of the other sex is not considered to alter essentially the sex character of the plant as a whole, which is regarded as still prevailingly male or female and as transmitting its sex as such. The behavior of prevailingly diœcious Mercurialis plants with reference to sex transmission seems to show that they are unit individuals male or female in a very strict sense, but it is considered clear that the diœcious condition is only an extreme, a climax condition in the evolution of sex differentiation. The data presented in considerable detail are thought

to indicate that the transition from the hermaphroditic and monœcious to the polygamo-diœcious and diœcious condition is going on at numerous and widely distributed points in the orders and families of seed plants.

Sex intergradation in the flowers of Mercurialis annua, C. YAMPOLSKY (*Amer. Jour. Bot., 7 (1920), No. 3, pp. 95–100, pl. 1*).—This is largely a synthetic discussion of papers previously noted, as indicated above. In the flowers of Mercurialis under observation, very elaborate and varied transition stages appeared of stamens into pistils and of pistils into stamens.

The variations noted as occurring in the three kinds of flowers appearing in Mercurialis, namely, male, female, and monœcious, are practically numberless. With the female flower as one extreme and the male flower as the other, flowers may grade all the way from each extreme to the other. While it has not yet been determined whether intergradation is here accompanied by sterility, the indications from the appearance of the pollen and the ovules suggest that total sterility does not occur.

The condition of intergradation within a series of flowers on a single plant introduces considerations bearing upon the question of when and how the sex of each flower is determined. The Anlagen or determiners, if there be such, must be different for the different flowers according to the arrangement of their parts. It must be borne in mind that in this so-called monœcious form of Mercurialis the sex of the plant changes in the course of the plant's development. The initial flowers are female. Several weeks after germination the young plant produces female flowers, and only female flowers are produced for several months. Then a few male flowers or hermaphroditic flowers appear. These increase in number as the season advances. As far as the whole plant is concerned, there is a periodic alteration of sex. A factorial hypothesis for sex can not explain these results. It would seem logical to assume that the sex of the flower is determined at the time of its formation and not when the plant of which it is a part is in the fertilized egg stage. In the various transitional forms there seems to be no definite factor which determines the sex of the flower; pistil passes into stamen and stamen into pistil at any time in its development. The argument for strict sex segregation is obviously nullified because of the behavior of these forms. The line of demarcation between what is male and what is female is wavering and vague. The evidence brought out here tends to emphasize an epigenetic condition for sex rather than the presence of definitely localized qualitative or quantitative factors.

Growth and variability in Helianthus, H. S. REED (*Amer. Jour. Bot., 6 (1919), No. 6, pp. 252–271, figs. 3*).—Growth and variability of a group of sunflower plants, under tolerably uniform field conditions, were measured by taking weekly records of the height of each plant during the grand period of growth, and the data so obtained were subjected to analysis. The facts cited led to the assumption that the relative size of plants is dependent upon internal genetic factors rather than external casual factors. Evidence was obtained that height was determined by factors which were distributed at random through the population. Further support for the assumption was found in the fact that plants in the extreme classes were less variable in regard to the mean relative height than plants in the intermediate classes.

The ecological relations of roots, J. E. WEAVER (*Carnegie Inst. Wash. Pub. 286 (1919), pp. 1–128, pls. 36, figs. 55*).—Studies noted previously (E. S. R., 32, p. 626; 41, p. 327) were extended in June, 1918, to the Great Plains and sandhill region of Colorado, also to habitats around Pikes Peak. This paper contains accounts of the study of roots as regards their character, depth, and distribution in about 140 species of plants, including shrubs, grasses, and some noxious weeds. Approximately 1,150 individual plants were examined in eight

communities, namely, the prairies of eastern Nebraska, the chaparral of southeastern Nebraska, prairies of southeastern Washington, the plains association and sandhill subclimax of Colorado, and the gravel-slide, half-gravel-slide, and forest communities of the Rocky Mountains of Colorado. The methods of procedure are outlined with discussion.

The roots examined, except as otherwise indicated, were of mature perennial plants. The practice was to examine carefully the root systems of a given species and write a working description of the type, which was used in comparison, utilizing also photographs or often drawings. The work, observations, and discussions are given in considerable detail.

Summary of notes on winter blooming at Washington, D. C., W. L. McAtee (*Biol. Soc. Wash. Proc., 32 (1919), pp. 129–132*).—The very mild winter of 1918–19 resulted in various unusual phenomena in the neighborhood of Washington, D. C., as regards the times of flowering of plants. These are divided somewhat arbitrarily into autumnal, late, early, and casual flowering, and lists are furnished under each head, with the observed time of flowering in case of each plant.

Adaptation of nodule bacteria to nonlegumes, G. Blunck (*Centbl. Bakt. [etc.], 2. Abt., 51 (1920), No. 1–4, pp. 87–90*).—In a preliminary communication the author states the problems and conditions of adapting a nodule organism to a nonleguminous plant. An account is to follow, stating in what degrees and in case of what plants the author has succeeded in accomplishing such adaptation.

Steeping, pickling, and inoculation of seeds, L. Hiltner (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 16 (1918), Nos. 7–8, pp. 73–83; 9–10, pp. 105–111*).—Discussion is given of results obtained in the course of experiments continued for several years in the treatment of seed of several sorts. It is thought that particular significance may attach hereafter to such treatments as applied to beet seed.

Germination and further development of the embryo of Zea mays separated from the endosperm, D. I. Andronescu (*Amer. Jour. Bot., 6 (1919), No. 10, pp. 443–452, pl. 1*).—Having worked on the threefold problem to ascertain the germination and further development of embryos separated from endosperms and also from scutella, to find a proper medium for the germination of embryos which will furnish a substitute for the removed endosperms and scutella, and to ascertain the effect in heredity, if any, of this traumatism, the author gives an account with discussion of this work as far as yet completed.

It is claimed to have been shown that normal maize plants may be developed from embryos lacking endosperms. The germination of embryos under these conditions seems to pass through exactly the same stages as in case of the germination of whole seeds, although the process is slower. The lack of endosperm in germination influences specifically the root system of the young plants less than it retards the whole development of the plant. The tendency toward a longer growth of plants from embryos without endosperms is reduced by the tendency of such plants to lessen their number of internodes. The presence of endosperms appears to be beneficial in the process of germination, as well as in the further development of the plants.

A study of plastids and mitochondria in Preissia and corn, W. C. Twiss (*Amer. Jour. Bot., 6 (1919), No. 6, pp. 217–234, pls. 2*).—The author has traced in root-tips from the embryonic region backward in case of *Zea mays* an unbroken series of bodies ranging from mitochondria to plastids, seriation being less obvious in Preissia. The existence of such definitely staining bodies (mitochondria) as normal constituents of cytoplasm is regarded as practically beyond

question, though the evidence for division of mitochondria and that for their function in heredity is regarded as inadequate, as is also that regarding the relations of the mitochondria to the remaining cytoplasm and regarding the nature of the imbedding material. Red staining bodies are present in the plastids of corn and in some cases also in those of Preissia.

Endothia pigments.—II, Endothine red, C. E. SANDO (*Amer. Jour. Bot., 6 (1919), No. 6, pp. 242–251, figs. 3*).—All three of the pigments described in the first paper of this series by Hawkins and Stevens (E. S. R., 38, p. 225) are found in *E. fluens* (pigment B abundantly). This species, grown in flasks on sterilized rice, thus constitutes an excellent source of material for the study of the red pigment.

Considerations detailed are held to justify the conclusion that endothine red is probably related to members of the pyrocatechin group. Further study is contemplated.

Studies on the rapidity of distribution of solutes in plants, L. BIRCH-HIRSCHFELD (*Jahrb. Wiss. Bot., 59 (1920), No. 2, pp. 171–262*).—Though inconclusive as to the problem of transport of materials in plants, this work is claimed to have made clear a series of relations of significance as fundamentals in the pursuit of further studies in connection or close relation with transportation problems.

The effect of potassium salts on the anatomy of Dactylis glomerata, O. N. PURVIS (*Jour. Agr. Sci. [England], 9 (1919), No. 4, pp. 338–365, figs. 23*).—A study at the Rothamsted Experimental Station of the effects of potassium salts on the anatomy of *D. glomerata* as here reported shows a yield of hay implying a normal season.

It was found that in the early but not in the later stages the sclerenchyma walls were thinner in cases where potash had been supplied. The lumina were larger where potash had been used in the absence of nitrogenous fertilizers, but the addition of ammonium salts reversed this result. Potassium fertilizer did not alter the thickness of the walls, but produced at first an increase in the ratio of lumen to wall. Presumably potassium fertilizer reduced the strength of mechanical cells in the early stages of growth.

The results here noted are held to indicate that the increased rigidity in plants supplied with potassium salts is not the result of anatomical strengthening. It may be due to the physiological influences of the salts or to changes in the chemical constitution of the plant.

The distribution of aluminum ions in plant organisms, J. STOKLASA (*Biochem. Ztschr., 88 (1918), No. 4, pp. 292–322*).—It is claimed that xerophytes contains very little aluminum, while hydrophytes have considerable proportions. Mesophytes in comparatively dry habitats have little, while those in moist situations have much more, particularly in the subterranean portions.

The action of vegetable enzyms on some organic substances, G. CIAMICIAN and C. RAVENNA (*Ann. Chim., 9. ser., 12 (1919), pp. 5–17*).—This article covers mainly the same ground as one previously noted (E. S. R., 42, p. 129).

Experiments cited are considered to show that even in pulverized plants there exist enzyms capable of determining selective oxidations, sometimes very energetic, and resulting in transformations which are indicated. The potentially oxidizing energy of plants (principally living plants) may be determined not by the more common oxidases, but more probably by protoplasmic enzyms insoluble in water and in glycerin. The facts are considered to confirm the hypothesis set forth in a paper previously noted (E. S. R., 37, p. 632), namely, that plants possess some very efficacious means of eliminating organic residual matters, one being oxidation.

Influence of sugars on the growth of albino plants, L. Knudson and E. W. Lindstrom (*Amer. Jour. Bot., 6 (1919), No. 10, pp. 401–405*).—In the course of previous work by Knudson (E. S. R., 36, p. 125) albino timothy seedlings occasionally occurred in the germination tests, and questions arose as to the influence of carbohydrates on albino plants and as to their power to exist and develop on the exclusive basis of organic material derived externally. The occurrence in Mendelian ratio (25 per cent) of albinos in the progeny of a hybrid corn studied by Lindstrom (E. S. R., 39, p. 825) rendered it possible to carry out these experiments.

The albino plants failed to make sustained and marked growth when supplied with sugar. This failure is supposed to be explained by the inability of the plant to absorb sugar rapidly and in part also by the relatively slow rate of conduction.

Uptake and anomalous osmotic coefficients of glycerin and urea, H. Fitting (*Jahrb. Wiss. Bot., 59 (1919), No. 1, pp. 1–170*).—Following up the discovery that the isotonic coefficients of a series of salts differed notably in certain connections from the expected values, the author has studied permeability in different plants, the results of which are detailed with discussion.

The influence of hydrocyanic acid on plants, C. Wehmer (*Biochem. Ztschr., 92 (1918), No. 5–6, pp. 364–375*).—An account is given of the effects of hydrocyanic acid on a few plants, chiefly trees (tops, roots, and seed), as subjected to the gaseous or solute form.

Influence of mines upon land and live stock in Cardiganshire, J. J. Griffith (*Jour. Agr. Sci. [England], 9 (1919), No. 4, pp. 366–395, pls. 13*).—It is stated on an area of about 3,000 acres within the sphere of influence of mine refuse in north Cardiganshire the unproductiveness of the land is due largely to the presence in the soil of toxic substances, mainly lead and zinc, occasionally a little copper. Iron pyrites and marcasite may also be causes contributory to the injury. Unfavorable changes in the mechanical composition of the soil led to deterioration of its physical properties, such as capacity to retain water. Leguminous crops are more susceptible than others.

Lead appears to be measurably retained by humic or other colloidal substances. It can be absorbed and apparently enters into the composition of the plant in minute quantities, but the poisoning of animals is due rather to lead deposited on the surface.

Sodium silicate tends to mitigate the injurious effects of mine refuse. The most effective remedy is an abundant addition of lime in excess of the so-called lime requirement.

Poison ivy and poison sumac and their eradication, C. V. Grant and A. A. Hansen (*U. S. Dept. Agr., Farmers' Bul. 1166 (1920), pp. 16, figs. 7*).—This publication describes the weeds and their distribution and differentiates between these and harmless similar plants. The author discusses the poisonous action of poison ivy and poison sumac and suggests preventive measures and remedies.

The methods deemed efficacious in destroying poison-ivy growth include spraying with salt brine (3 lbs. of salt to the gallon of water), repeated several times if found necessary at intervals of a week or two, pulling by hand or grubbing out small areas, frequent mowing, and in fields, plowing followed by the cultivation of hoed crops. When poison sumac grows along the edges of paths or roads or in frequented places it should be cut off close to the ground, after which the roots should be grubbed out or killed by applying salt, crude oil, or chemicals to the newly cut surfaces and the surrounding soil.

FIELD CROPS.

[Report of work with field crops in Kansas, 1918–19] (*Kansas Sta. Rpt. 1919, pp. 26–35, 36, 37, 38, 81*).—This reports the progress of work previously noted (E. S. R., 41, p. 32).

Kanred winter wheat again manifested its superiority over other varieties by exceeding the average acre yields of Turkey, Kharkof, and local varieties by 3.4, 4.2, and 3.6 bu., respectively, in about 250 experimental tests with farmers and at the substations. Local varieties were outyielded in all but 10 tests. In addition to its marked resistance to rust and winterkilling, tests indicate equality to other varieties as a milling wheat.

Seeding wheat in furrows produced an average gain of 0.9 bu. per acre for a 9-year period over seeding in the usual way. At the Colby Substation, wheat seeded in furrows on fallow land and on corn ground produced 3.2 and 4.4 bu., respectively, more than that sown by the common method, and at Fort Hays an average gain of about 2 bu. was secured by the furrow method.

Sweet clover seeded alone produced good stands, but failed to germinate when sown with oats as a nurse crop. Rate of seeding was apparently not an important factor, as good stands were secured with as little as 5 lbs. of seed per acre. Seedings in March and April gave better results than those made later.

Crop improvement work included breeding work with wheat, corn, oats, sorghum, and minor cereals, and studies of disease resistance and of the factors influencing winter and spring types. Promising wheat varieties included Kansas No. 2048 (Alberta Red), C. I. No. 5170, a beardless, hard red winter wheat, and a number of pure line selections of hard winter Defiance. In tests of improved oat varieties, Kansas No. 5179 (Fulghum) made a 3-year average acre yield of 87 bu. as compared with 81 bu. for the highest yielding Burt, 72 for Red Algerian, and 70 for Sixty Day. In a comparison of yields of F_1 corn hybrids with parental varieties, Pride of Saline×Minnesota No. 13 exceeded the average yields of parents by 8 bu.

The 1918 results in the experiment on the effects of cutting alfalfa at different stages of growth emphasized previous findings showing the danger of early cutting and the possibility of delaying cutting without permanently injuring the stand. Analyses of alfalfa hay cut at different stages of maturity show in general that the percentage of protein is greatest in hay cut in the bud stage and decreases slightly in that cut in each of the later stages. The full bloom stage, however, gave the highest total yield of nutrients. Early cutting of alfalfa plants stimulated the growth of grasses and weeds to such an extent that the hay from the fifth cutting of the bud-stage plats consisted of but 15 per cent of alfalfa. When cuttings were made in the full-bloom stage or later, no grass or weeds were found in the plats.

Sweet clover cured in the sun was found to contain a higher pure protein content than that cured in the shade. The leaves contain about two and one-half times as much total protein and about three times as much pure protein as the stems, while the stems contain three to four times as much crude fiber as the leaves.

When alfalfa was cut at four stages of maturity, i. e., bud, one-tenth bloom, full-bloom, and seed-formation, samples being cured in the sun and in the shade and the process in each case of curing prolonged by sprinkling, the following chemical changes were found most pronounced:

Prolonging the period of drying produced a larger amount of water-soluble nitrogen. Samples dried in the shade had a larger percentage of water-soluble nitrogen than those dried in the sun, and sprinkling increased the amount of

water-soluble nitrogen for both. Prolonging the period of drying also increased the amount of protein nitrogen. The samples dried in the sun had a larger percentage of water-soluble carbohydrates than those dried in the shade. Sprinkling decreased the water-soluble carbohydrates, both for samples dried in the shade and those dried in the sun. Samples dried in the sun and not sprinkled had four to five times as large a percentage of water-soluble carbohydrates as those dried in the shade and sprinkled. All changes were more marked in the alfalfa cut in the bud stage than that cut in the later stages.

Results of State-wide tests of cereal varieties, rotation and fertilizer tests, and miscellaneous tests in crop production conducted in cooperation with farmers from 1911 to 1918 are said to show that acclimated varieties of corn are superior to introduced varieties; the superiority of Kanred wheat for all soil types throughout the hard wheat-growing section of the State; the efficacy of phosphatic fertilizers on shale and sandstone soils for winter wheat, alfalfa, and clover; and the relative inefficiency of the same fertilizers on the same soils for oats, kafir, and corn.

Where similar areas of dead pasture grass were burned at different dates, it was observed that burning caused an earlier growth of grass and provided pasture earlier in the season, but the total yield, as shown by harvesting the hay from small plats, was smaller from the burned than from the unburned areas. The soil on the burned areas was said to be warmer than on the unburned areas throughout the season.

Barnyard manure proved better than green manures for potatoes, although on land planted repeatedly to this crop, green manures have given fair returns.

Variety yields of farm crops for 1920, M. E. McCollam (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 7, pp. 104–106*).—The leading varieties in 1920 with their yields per acre were as follows: Three Grain spring oats 68.3 bu., Gray Winter oats 39 bu., Coast barley 49.4 bu., Rosen rye 36.7 bu., Brown Squarehead winter wheat 44.6 bu., Red Chaff spring wheat 30.8 bu., purple vetch 16.2 bu., and Golden Vine field peas 31.5 bu.

Seedings of oats at the rate of 100, 120, and 140 lbs. per acre resulted in respective yields of 46.7, 48.4, and 46.4 bu., and spring wheat sown at rate of 90, 120, and 150 lbs. per acre yielded 30.2, 34.2, and 33.1 bu. per acre, respectively, indicating that the medium rates give best results for both spring wheat and oats. When field peas were sown in amounts of 2.5, 3, and 3.5 bu. per acre, the respective yields were 26.7, 34.9, and 38.4 bu.

[Report of field crops work in Wisconsin, 1918 and 1919] (*Wisconsin Sta. Bul. 319 (1920), pp. 3–26, figs. 12*).—This describes the progress of work previously noted (E. S. R., 42, p. 337).

The work of A. H. Wright in furthering the development of the hemp industry of the State is outlined. It is stated that Wisconsin now leads the country in hemp culture, growing about one-third the entire acreage of the United States. The average yield for the State during the year was about 1,100 lbs. of total fiber per acre. Cooperative tests with the U. S. Navy have indicated that Wisconsin hemp is equal to the Kentucky product. Experiments with fiber flax conducted by Wright on the leading soil types of the State so far indicate that the crop can be grown in various portions of the State, especially in the northern counties.

Efforts made by Wright to improve sorghum seed and studies of improved methods of manufacturing sirup are noted. Cooperative tests with farmers of the State confirmed previous results indicating that varieties from States south and southwest mature too late for Wisconsin conditions. The possibilities of sorghum manufacture and the necessities of improved methods are noted. See also a previous note (E. S. R., 43, p. 335).

In breeding for a type of corn suited to the forage needs of the dairy business, E. J. Delwiche has found that Wisconsin No. 25, a selection from a cross between Wisconsin No. 8 and a small, early maturing yellow dent, ripened within 100 days at the Spooner Substation in 1919, producing 85 bu. of shelled grain per acre. In the hands of farmers, the yields ranged from 40 to 65 bu. of grain, and from 8 to 15 tons of silage per acre. Chippewa Flint, a hybrid between two strains of white flint corn secured from the Indians, has been selected for the northern portion of the State for hogging-off and grain purposes.

Cooperative field trials with the cold-resistant strain of Golden Glow developed by B. D. Leith substantiated results of the previous season. When planted a week earlier than the parent variety, observations during the growing season showed it to possess better development, more luxuriant growth, and greater vigor.

Breeding work with sweet corn was conducted by E. D. Holden. When two lots of corn from single stalks bearing one ear and from single stalks bearing two ears were run through the cutter at the factory, it was found that the two-eared stalks yielded twice as much corn as the single-eared stalks. The two-eared stalks also possessed greater size and vigor than the average. This and similar tests indicated the desirability of using the two-eared type as a basis for future selection.

Work with small grains at Madison was conducted by Leith. Although Pedigree No. 1 is more generally adapted to Wisconsin conditions than any other oats variety, it produced an 8-year average of but 71.8 bu. on rich bottom land as compared with 74.4 bu. for Pedigree No. 7 for the same period, indicating the superiority of the latter for the peculiar adverse conditions. Two-year average yields of promising hybrid strains of oats have ranged from 46 to 51 bu. per acre.

Rosen rye yielded 25.6 bu. of 48.8 lbs. weight as compared with Pedigree No. 2 rye with 42.1 bu, of 54 lbs. weight. Results do not warrant the substitution of Rosen for pedigree varieties on the silt loams of southern Wisconsin.

Average acre yields of pedigreed winter wheat tested during a series of years ranged from 30.5 to 35.8 bu., while those of spring wheats ranged from 13.2 to 25.3 bu. The general trend of the data is held to show that winter wheat on the whole yields higher than spring varieties, and because of the lesser liability to crop failure the culture of winter wheat is generally recommended. Although about September 20 was found to be the optimum date for seeding winter wheat, seedings as late as October 10 did not suffer greatly in yield.

Tests conducted by Delwiche at the substations in the northern part of the State revealed that winter wheat was a better crop than spring wheat, especially at Ashland. Pedigree No. 408, Bacska, a winter variety, made a 4-year acre average of 32 bu. while Marquis produced but 14.9 bu. per acre during the same period.

Several pedigreed varieties of field and garden peas have been developed at the northern stations, Delwiche reporting notable success with pedigreed Scotch and pedigreed Green varieties. The main objects in the improvement of canning varieties are considered to be yield and uniformity of ripening. In soy bean variety tests, Pedigree No. 1, a strain of Early Black, has given the best average results.

Scarification of legume seed in studies by L. F. Graber increased the germinability of sweet clover from 5 to 95 per cent. Alfalfa seed was improved to a lesser degree. Grimm alfalfa containing 20 to 25 per cent of hard seed was

improved in germination from 15 to 17 per cent by scarification. These results are held to confirm those of other stations showing the desirability of scarifying where the seed contains over 10 per cent of hard seed.

Sudan grass averaged between 3 and 4 tons of cured hay per acre during a 4-year period in experiments made by G. B. Mortimer. Seeding with the grain drill produced the best hay yields although cultivated rows also gave good results. When sown broadcast, from 20 to 25 lbs. of seed to an acre is considered sufficient. The optimum planting period ranges from corn-planting time until June 10. Growing the crop with soy beans is said to have met the criticism of low protein content. Cowpeas, however, proved of little value in combination with the grass, as the plants made but little growth.

Experiments by Graber on the desirability of mixing timothy and alfalfa, previously noted (E. S. R., 42, p. 632), are described. Cooperative tests on the study of drought resistance are held to indicate that alfalfa is decidedly more resistant toward drought than either red or alsike clover. The more widely and finely branched and comparatively shallow root system of the clovers are considered the causes of poor resistance. Grimm did not show a greater drought resistance than common alfalfa. In fact, common alfalfa is said to have revived much quicker following a dry spell.

Although sunflowers cut when the seeds were in the dough stage produced from 6.5 to 26.5 tons of forage according to rate of seeding, rust and drought are thought to have rendered the silage so unsatisfactory that dairy cows refused to eat it. It is felt that more satisfactory results will be necessary to recommend the crop as a substitute for corn under the humid conditions of Wisconsin.

Comparisons of various methods of harvesting soy beans were made by H. W. Albertz. The use of the mower and the grain binder has been fairly successful, but the best results appear to be obtained by the use of a combined harvester and thrasher. Inoculation experiments indicated that soy bean nodule bacteria are capable of living under field conditions for a period of 17 years. Part of a field planted to soy beans in 1902 was again seeded to soy beans in 1919. No nodules were found on the roots of plants on that part of the field that had never grown soy beans, while all the plants examined on the other portion of the field had nodules. A Truog acidity test of the soil indicated a slight to a strong acidity. Soy bean nodule bacteria are considered apparently tolerant to soils with a medium to a strong acid reaction and not requiring reinoculation if once inoculated in the course of rotation.

Systematic experiments, C. A. Zavitz (*Agr. Gaz. Canada, 7 (1920), No. 3, pp. 244–246*).—Summarized results, in tabulated form, of the different grain crops tested throughout Ontario in 1919 by the Ontario Agricultural College and the Ontario Experimental Union are presented, together with the results of cooperative tests with potato varieties and a comparison of southern and northern grown seed potatoes.

[Report of field crops work in North Wales, 1917–1919], T. J. Jenkin and A. Roberts (*Univ. Col. No. Wales, Bangor, Dept. Agr. [Pub.], 1920, pp. 3–40*).—Variety and rate of seeding tests and studies of the quality and proportion of kernel to husk with oats are reported, in addition to tests of potato varieties and seed-potato preparation, work with pasture grasses and pasture improvement, and experiments on the eradication of bracken and yellow rattle.

Dry farming in western South Dakota, O. R. Mathews (*U. S. Dept. Agr., Farmers' Bul. 1163 (1920), pp. 16*).—This publication reports the results of studies of methods of crop production on the dry farming units of the Belle Fourche Substation, near Newell, S. Dak., since 1908, and on the Ardmore Sub-

station since 1912. A description of the region is included, and the best adapted varieties of field crops and approved cultural methods are indicated.

The average yields of grain and forage crops at both substations during a series of years are as follows:

Yields of wheat, oats, barley, corn, and sorghum at the Belle Fourche and Ardmore (S. Dak.) Substations.

Locality.	Wheat.	Oats.	Barley.	Winter wheat.	Corn.		Sorghum stover.
					Grain.	Stover.	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lbs.*	*Lbs.*
Belle Fourche, 1909–1919	13.4	29.8	18.0	13.8	16.2	1,912	4,146
Ardmore, 1912–1919	16.7	31.1	17.2	15.9	16.0	1,915	5,654

The author states these yields should be profitable, but owing to the fact that the average is made up of exceedingly heavy yields in a few years, and low yields or failures in other years rather than fairly good yields each year, a stable agriculture based upon grain production alone has not been established.

The results of these investigations and the experience of successful farmers are held to show that the high fluctuation of yields, due to varying rainfall, can not be overcome sufficiently by cultural methods to change the problem materially, and to indicate further that the most favorable conditions for grain production are found when combined with or subordinated to stock production. The author recommends a system of farming embracing the keeping of live stock to the capacity of summer pasture and winter feed; the growth of cultivated annual crops, corn and sorghum, for winter feed; and the growth of small grains following the corn without plowing.

A few hints on labeling in experiment stations, T. S. VENKATRAMAN (*Agr. Jour. India, 15 (1920), No. 1, pp. 45–50, pls. 3, fig. 1*).—The author describes the methods employed in labeling the experimental plats at the Cane Breeding Station at Coimbatore, Madras Presidency, and compares the relative efficiency and cost of the various types of labels. A system of plat labels giving the exact plan of each plat, with a certain amount of information about the parents, has proved to be a great convenience in field work, dispensing with bulky notes and diagrams. In discussing the preparation of paraffined labels, it is noted that this type is not affected by rain or sun, can be easily cleaned, and is practically immune from the attacks of the silverfish.

Some labor-saving devices in plant breeding, A. and G. L. C. HOWARD (*Agr. Jour. India, 15 (1920), No. 1, pp. 5–10, pl. 1, figs. 4*).—These include muslin bags for the exclusion of foreign pollen from selections of flax, gram, tobacco, jute, and patwa; drying-boxes and envelopes for the handling of seed from individual plants; a drying and thrashing house for variety tests; and bins for the storage of seed under extreme climatic conditions.

The need for uniform grades for hay, H. B. MCCLURE (*Amer. Elevator and Grain Trade, 39 (1920), No. 1, pp. 44–49, fig. 1*).—This paper, a contribution from the U. S. Department of Agriculture presented at the twenty-seventh annual convention of the National Hay Association, comprises a discussion of the work of the Bureau of Markets in the study of methods of marketing hay and the factors involved in shipping and selling hay by grades.

In discussing the chemical analyses of samples of different kinds of hay, the author states that although certain weeds, wire grasses, and "other" tame grasses lower the grade of timothy hay, they do not necessarily detract from

the feeding value unless unpalatable or harmful, and he deplores the practice of rejecting really good hay on account of a few harmless weeds. He notes that while analyses may determine the amount of nutrients in hay, the factor of palatability, which the animal itself must decide, is of prime importance. Tabulated data are included showing effect of environment, maturity, and fertility on the protein content of timothy, average percentage of composition of plants in market hay, total dry matter, and digestible nutrients in a ton of hay, and the actual market value of hay.

G. A. Collier, of the Bureau of Markets, led the discussion on the foregoing, outlining the plans for the establishment of Federal grades for hay.

Grades of hay and straw (*Natl. Hay Press, 3 (1920), No. 11, pp. 17–20*).—A description of the grades of hay, prairie hay, Johnson hay, Bermuda hay, lespedeza hay, alfalfa hay, and straw established by the National Hay Association and revised July 14, 1920.

Factors that affect alfalfa seed yields, P. K. Blinn (*Colorado Sta. Bul. 257 (1920), pp. 32, figs. 27*).—Continuing work previously noted (E. S. R., 28, p. 42; 30, p. 35), this reports the progress of experiments to determine the controlling factors in alfalfa-seed production. The investigations embraced studies of the seed-setting tendencies of the different varieties and the effect of seed selection on improvement of seed yields; moisture requirement, irrigation, cultural, and spacing tests; and observations on the relations of insects, climatic conditions, and soil fertility of alfalfa-seed production. Much of the work was carried on in cooperation with the Office of Forage-Crop Investigations of the U. S. Department of Agriculture. The conclusions, which are deemed somewhat indefinite, may be summarized as follows:

A difference in the inherent seed-setting tendency of different strains of alfalfa was noticeable, the southern strains, particularly from Ecuador, Peru, and Tripoli appearing to be strongest in this respect. These are not considered adapted to the climatic conditions, lacking hardiness. Although seed selection for prolific seed yield improved the ability of the selected stocks to produce seed yields, the improvement is not thought sufficient to solve the problem.

The amount of moisture for alfalfa-seed production should be so regulated that a minimum amount of forage growth will result and still have water enough to fill and mature the seed. Pasturing off the first growth late in the spring has apparently stimulated good seed yields. Good seed yields seem to be coupled with an arrangement of the irrigation system such as to regulate the amount of water and hold it close to a minimum requirement. Apparently this is best done by having small irrigation furrows about every 30 in. and thus irrigating by the furrow method.

A thin, uniform stand, about 1 plant to 1 or 2 sq. ft. is thought necessary for the best seed-production results. Growing alfalfa in rows is held objectionable, principally on account of the difficulty in handling the crop with machinery.

But very little evidence that bees are essential to alfalfa-seed yields was discovered. Dry climatic conditions with high temperatures seem to be among the most essential requirements for successful alfalfa-seed production. While the effect of fertilizer or nutritive substances on alfalfa-seed production has not been investigated, the author states that indications point to soil nitrates in excessive quantities as a serious cause of poor seed yields in many irrigated regions.

Alfalfa (*U. S. Dept. Agr., Dept. Circ. 116 (1920), pp. 6*).—The crop is briefly described and cultural methods and field practices adapted to growing alfalfa in Ohio, Indiana, Illinois, Iowa, Missouri, and Kentucky indicated.

Dry-land alfalfa (*U. S. Dept. Agr., Dept. Circ. 122 (1920), pp. 4*).—This circular briefly discusses a strain of alfalfa developed under dry-land conditions,

and indicates methods and rates of seeding applicable to both northern and southern portions of the Great Plains region.

Grimm alfalfa (*U. S. Dept. Agr., Dept. Circ. 123 (1920), pp. 4*).—This contains a brief description of the variety, together with notes on its origin, adaptation, and cultivation.

Peruvian alfalfa (*U. S. Dept. Agr., Dept. Circ. 117 (1920), pp. 6*).—This circular describes Peruvian alfalfa and presents popular instructions for the culture of the crop in the Southwestern, South Atlantic, and Gulf States.

Better seed corn, C. P. HARTLEY (*U. S. Dept. Agr., Farmers' Bul. 1175 (1920), pp. 14, figs. 9*).—This publication is essentially a revision of the material included in Farmers' Bulletin 415, already noted (E. S. R., 24, p. 36).

Waxy maize from Upper Burma, G. N. COLLINS (*Science, n. ser., 52 (1920), No. 1333, pp. 48–51*).—Samples of corn with waxy endosperms, secured from Upper Burma and other Asiatic sources, are described. The author also discusses the behavior of the waxy endosperm of corn in genetic experiments (E. S. R., 22, p. 443; 32, p. 134; 41, p. 437), holding that the finding of this peculiar type of endosperm in the mountain region of Upper Burma supports the idea that corn entered China from the West instead of from the East. He further suggests that a more thorough knowledge of the maize varieties of the Himalayan regions promises to be the key to the distribution of maize in Asia.

A progress report on cotton breeding at the Sultanic Agricultural Society, G. F. FREEMAN (*Sultan. Agr. Soc., Tech. Sect., Bul. 3 (1920), pp. 16*).—This outlines a plan for the purification and improvement of Egyptian cotton varieties. The plan is designed to give a continuous supply of seed pure to type and never more than six years removed from a single selected mother plant, and providing for any advantage that might accrue from the appearance of promising mutants occurring in the improved strain, or in fields of farmers elsewhere. The procedure is based on the study of factors of yield and quality, physiological and genetic correlations, and the inheritance of quantitative characters, and the operations may be grouped under the following headings: (1) Selection of original mother plants—from fields specially planted, from the subsequent pedigree plats, or from any field of the same variety; (2) first-year pedigree plant plats—from carefully selected plants of (1); (3) second-year pedigree plant plats—from close or open pollinated seed of best plants of best plats of (2); (4) third-year pedigree plant plats—from close-pollinated seed of best plants of best plats of (3); (5) first-year pedigree increase plats—from close-pollinated seed of best plants of best plats of (4); (6) second-year pedigree increase plats—from best plats of (5) after careful roguing; and (7) pedigree field—from the few finally best plats of (6) after careful roguing. Each of these operations may be carried on every year.

The staple of Texas cotton, E. P. HUMBERT ET AL. (*Texas Sta. Bul. 266 (1920), pp. 7, fig. 1*).—The average lengths of staple and the drag, or body, of 40 varieties and strains of cotton grown at the Texas Experiment Station and nine substations are shown in tabular form. This material will be supplemented by a later publication giving data regarding yields, percentages, etc.

Cotton growing in Tungchow, B. Y. LEE (*Cotton, 84 (1920), No. 6, pp. 385–389, figs. 6*).—A popular description of the cultural methods and field practices employed in the culture of cotton in the Tungchow District in China, together with notes on ginning methods, marketing customs, and land tenure. Limited results of experiments, including method and depth of planting and fertilizer tests, conducted by the Tungchow Cotton Experiment Station, are included.

Cowpeas (*U. S. Dept. Agr., Dept. Circ. 119 (1920), pp. 4*).—A popular description of the cowpea, with brief notes on adaptation, inoculation, culture, harvesting, thrashing, seed, varieties, and group nomenclature.

Philippine fiber plants, W. H. Brown (*[Philippine] Bur. Forestry Bul. 19 (1919), pp. 115, figs. 31*).—A catalogue of the fiber plants, other than bamboos and palms, found in the Philippine forests. Descriptions, including local names and uses of the various species, are presented, in addition to dimensions and tests of tensile strength of the fibers.

Field pea (*U. S. Dept. Agr., Dept. Circ. 118 (1920), pp. 4*).—The field pea (*Pisum sativum*) is briefly described, the outstanding points of the principal varieties indicated, and cultural and harvesting practices outlined.

Proso, or hog millet, J. H. Martin (*U. S. Dept. Agr., Farmers' Bul. 1162 (1920), pp. 15, figs. 4*).—The origin and adaptation of proso, or hog millet, are discussed, field practices employed in growth and handling the crop are described, and methods of combating diseases and pests briefly indicated. The author outlines the uses of proso for human food and as feed for live stock, and presents an original descriptive key to the leading varieties of proso grown in the United States or proving of value in experiments conducted by this Department.

The cultivation of ragi in Mysore, L. C. Coleman (*Mysore Dept. Agr., Gen. Ser., Bul. 11 (1920), pp. [2]+67, pls. 22, figs. 2*).—A treatise on the culture of ragi (*Eleusine coracana*), a millet forming the staple food crop of Mysore and occupying over one-third the total cultivated area.

The author describes native and improved cultural methods and field practices, and presents tabulated results of a number of experiments, including variety, fertilizer, and cultural tests and rotations. The distribution of ragi, and the areas of early, late, and irrigated types are indicated on outline maps; and the varieties, their comparative yields, and improvement by selection are set forth in considerable detail, together with brief notes on diseases and pests of the crop. In addition to descriptions and analyses of the ragi soils of Mysore, outlines of the practices peculiar to cultivation in the eastern and western divisions of the State are appended.

[Rice work of the Porto Rico Experiment Station, 1918], W. A. Mace (*Porto Rico Sta. Rpt. 1918, p. 24*).—Work with rice, including variety, cultural, and irrigation tests, and conducted in cooperation with the Office of Cereal Investigations of the U. S. Department of Agriculture, is briefly noted.

Wild rice (Zizania aquatica), D. Evans (*Rice Jour. and South. Farmer, 23 (1920), No. 8, pp. 27, 28, fig. 1*).—A popular article including a description of the plant, its distribution and uses, together with a discussion of the harvesting methods used by the Indians of the Dakotas and Minnesota.

Cane experiments in St. Croix, E. Gedde (*Agr. News [Barbados], 19 (1920), No. 473, pp. 180, 181*).—Sugar cane at the Slob Experiment Station, St. Croix, planted at distances of 5 by 2, 4.5 by 3, 4 by 2, 3.5 by 3.5, and 3 by 3 ft., made average yields of 37.3±1.88, 39.6±2.23, 40.5±0.77, 41.5±1.28, and 43.7±1.07 tons per acre, respectively. From these results the experimenter concluded that the best yields are to be obtained when canes are planted equidistant in both directions.

Plantings of cuttings from the tops of plant canes, first ratoons and second ratoons, produced average acre yields of 41.8±2, 45.8±2.15, and 34.3±3.17 tons, respectively, indicating the superiority of first ratoon canes for planting material.

Packing seed sugar canes for transport, T. S. Venkatraman (*Agr. Jour. India, 15 (1920), No. 2, pp. 174–180, pls. 2*).—Detailed instructions are presented for the treatment, packing, and labeling preparatory to shipping seed cane short distances by rail or steamer, and in oversea consignments. The main considerations in the packing of cane material are held to include the protection of the cut ends to prevent evaporation; protection of the buds against

such injury as to result in impaired germination; and the treatment of the material to prevent entry of disease and to destroy, if possible, any disease already existing in it.

Sweet clover (*Agr. Gaz. Canada, 7 (1920), No. 2, pp. 121–130, figs. 8*).—This includes articles reporting the results of the more recent experiments and observations of the crop in several of the Canadian Provinces as follows: Sweet Clover and Its Value, by R. Summerby; Sweet Clover for Green Manure, by J. H. Ellis; Sweet Clover as a Feed, by G. W. Wood; Sweet Clover Culture, by L. E. Kirk; Observations on Sweet Clover, by G. H. Cutler; Sweet Clover Problems, by P. A. Boving; and Sweet Clover Demonstrations, by F. C. Nunnick.

Stocks of leaf tobacco (*Bur. of the Census [U. S.] Bul. 143 (1919), pp. 54, fig. 1*).—The data contained in this bulletin is essentially the same as that noted previously (E. S. R., 42, p. 237), with the statistics presented brought up to date.

A note on the wheats and barleys of Mesopotamia, C. R. Wimshurst (*Mesopotamia: Agr. Dir., 1920, pp. [1]+19, pls. 4*).—A report of surveys in 1918–19 of the wheat and barley grown along the Euphrates, Tigris, and Karun Rivers, including detailed notes on varieties, cultural methods, diseases, and crop pests.

The shoq plant (*Prosopis stephaniana*) is described as occupying an important position in the culture of wheat and barley in Mesopotamia. Besides being considered a reliable indicator of soil fertility, it rejuvenates the soil by deep root penetration, acts as a cover crop during the summer, and is a valuable source of forage, organic matter, and fuel.

What has been done to improve the wheat crop in Canada, J. G. C. Fraser (*Agr. Gaz. Canada, 7 (1920), No. 5, pp. 384–388, figs. 5*).—A review of the work of the Dominion Experimental Farms in the improvement of the wheat crop in Canada, in addition to notes on the outstanding points of the more valuable introductions, hybrids, and selections developed by the Dominion Government.

Electrical treatment of seed, S. C. Lee (*Agr. Gaz. Canada, 7 (1920), No. 3, pp. 248, 249*).—Wheat grown from electrically treated seed at the Manitoba Agricutlural College in 1919 gave acre yields of 18 bu. of grain and 4,800 lbs. of straw, as compared with 14.5 bu. and 4,226 lbs. from seed not treated. During the earlier period of growth no apparent difference was observed between the two plats, but toward maturity the plat from the treated seed showed a slightly ranker growth of straw and ripened more slowly. Although the results were in accordance with preliminary laboratory tests, the field tests were thought too limited to warrant definite conclusions.

Seed laws of the United States, compiled by C. N. Smith (*Boston: Author, [1919], pp. 235*).—A compilation of the laws of the Federal Government and of the several States, regulating the sale of field seeds and garden seeds.

Proceedings of the Association of Official Seed Analysts of North America, 1916–17 (*Assoc. Off. Seed Anal. No. Amer. Proc., 1916–17, pp. 80, figs. 2*).—Brief summaries of the activities of the association are included, together with papers presented at the annual meetings in 1916 and 1917.

The following papers were presented at the ninth annual meeting: Seed Legislation, by E. M. Freeman; Seed Regulation as a Seedsman Sees It, by G. E. Green; Some Problems of Efficiency in Seed Testing, by O. A. Stevens; Studies in Tolerance for Purity Variations, by C. P. Smith; Further Importation of Low-Grade Seed Subject to the Seed Importation Act, by E. Brown; The Germination of Seeds of *Agropyron repens*, by R. C. Dahlberg; Germination and Viability Tests of Johnson Grass Seed, by G. T. Harrington; The Chloral

Hydrate Test for *Brassica arvensis*, by L. M. Allen; Paper Packet Seeds, by J. R. Dymond; Germination of Seed Oats, by W. L. Goss; Report of Lespedeza Germination Tests, by M. Dworak; An Effort at Seed Standardization and Seed Certification, by H. L. Bolley; and A Mechanical Device for Placing Samples of Seed into Germination Tests, by H. D. Hughes.

Papers presented at the tenth annual meeting included the following: Pure Seed Work in Wyoming, by T. S. Parsons; Some Germination Studies with Canner Peas, and Germination of Seeds of Dodder Found in Seed Samples, both by M. T. Munn; A Study of Chaff in Grass Seed with Special Reference to Brome Grass, Notes on the Work of the Year 1916–17 at the North Dakota Seed Laboratory, and Notes on the Absorption of Water by Seeds of the Cereals, all by O. A. Stevens; Further Studies of the Germination of Johnson Grass Seeds, by G. T. Harrington; Distinguishing the Seeds of Redtop and Bent Grasses, by F. H. Hillman; Operation of the Seed Importation Act, and Voluntary Labeling of Field Crop Seeds by Seedsmen, both by E. Brown.

Eleventh annual proceedings of the Association of Official Seed Analysts of North America, 1919 (*Assoc. Off. Seed Anal. No. Amer. Proc., 1919, pp. 68*).—This comprises a report of the eleventh annual meeting of the association, and a summary of its activities during 1918. The following papers were presented: Organization, Development, and Activities of the Association of Official Seed Analysts of North America, by G. T. French; Research and Seed Testing, and The Organization of the Colorado Seed Laboratory, both by W. W. Robbins; Official Field Crop Inspection, by H. L. Bolley; The Seed Analysts' Responsibility with Reference to Seed-borne Plant Diseases, by M. T. Munn; Cooperation Between the Seed Analysts' Association and the Seed Trade, by W. L. Oswald; Voluntary Labeling by Seedsmen, by E. Brown; Seed Laws and Seed Testing from the Viewpoint of Seedsmen, by W. G. Scarlett; Optimum Temperatures for the After-ripening of Seeds, by W. Crocker; Relation of Varying Degrees of Heat to the Viability of Seeds, by J. L. Burgess; The Problem Presented in Obtaining Satisfactory Germination Tests on Newly Harvested Grain and Grass Seeds, by A. L. Stone; Forcing the Germination of Blue Grass, by B. C. Hite; Comparative Chemical Analyses of Johnson Grass Seeds and Sudan Grass Seeds, by G. T. Harrington; Greenhouse and Germinating Chamber Tests of Crimson Clover Seed, by W. L. Goss; and Rhode Island Bent Seed and Its Substitutes in the Trade, by F. H. Hillman.

Third annual report of the Colorado seed laboratory, W. W. Robbins and G. E. Eggington (*Colorado Sta., Seed Lab. Bul., 2 (1919), No. 2, pp. 5–27, figs. 5*).—This outlines the activities of the laboratory during the year ended November 30, 1919. A total of 3,823 samples of seed were examined in the period covered by the report. The weed seeds most common in important crop seeds sold in the State are indicated, and a list of the weed seeds found in the samples analyzed is presented.

Irrigation water as a factor in the dissemination of weed seeds, G. E. Egginton and W. W. Robbins (*Colorado Sta. Bul. 253 (1920), pp. 25, figs. 7*).—Investigations to determine the extent of distribution of weed seed by means of irrigation water are described. Individual catches of weed seeds secured by floating traps in irrigation ditches at different times in the season and samples of soil from the ditches were analyzed and the different species and the number of seeds caught indicated. The frequency of different species of seed in the samples and the results of buoyancy tests of seeds of the different species are presented in tabular form.

The authors state that the factors affecting the number of weed seeds carried in irrigation ditches include the flora of the ditch bank and adjacent territory,

the season of the year, the velocity and direction of the wind, the velocity of the irrigation stream, and the buoyancy of the weed seeds. The ditch banks are considered to be worse than roadsides as sources of weed infestation.

In 156 weed-seed catches from three different ditches, a total of 81 different species of weeds were found, prostrate pigweed, tall pigweed, sedge, lamb's quarters, tall marsh elder, door weed, black bindweed, curled dock, and dandelion being the most numerous. The number of weed seeds passing a given point on a 12-ft. ditch during a period of 24 hours may reach several millions.

The early spring irrigation waters are said to be the most heavily loaded with weed seeds and should not be turned into field laterals until considerable water has run through the ditches. Many weed seeds were found to rest in the mud of the ditch during the nonirrigating season.

Weed seeds differ in the readiness with which they sink or float, the buoyancy being determined somewhat by the condition of the water surface and the manner in which the seeds alight upon it. It is noted that some seeds float for days no matter how they strike the water surface or how it is agitated; some float if laid on the water carefully and the surface is not disturbed, but sink readily if the surface is agitated, or sink almost immediately if they strike the surface with some force.

Grazing is recommended as an effective and economical method of controlling weeds along large irrigation ditches. The seeding of ditch banks to brome grass (*Bromus inermis*) is also encouraged.

Weed control measures [in Canada], M. Cumming et al. (*Agr. Gaz. Canada, 7 (1920), No. 6, pp. 484–488, figs. 6*).—These articles relate the progress of weed eradication and control by legislation and educational methods in the Provinces of Nova Scotia, New Brunswick, Quebec, Ontario, and Alberta.

Information obtained from experiments in weed control conducted cooperatively under the supervision of the Ontario Agricultural College for eight successive years may be summarized as follows: Good cultivation followed by rape sown in drills provides a means of eradicating both perennial sow thistle and twitch grass. Rape is a more satisfactory crop to use in the destruction of twitch grass than buckwheat, and gives much better results in the eradication of twitch grass and perennial sow thistle when sown in drills and cultivated than when broadcasted. Thorough, deep cultivation in fall and spring, followed by a well-tended hoed crop, will destroy bladder campion. Mustard may be prevented from seeding in oats, wheat, or barley by spraying with a 20 per cent solution of iron sulphate without any serious injury to the standing crop or to fresh seedings of clover.

HORTICULTURE.

Horticulture at high altitudes, R. A. McGinty (*Colorado Sta. Bul. 256 (1920), pp. 19, figs. 8*).—A progress report on experiments with orchard and small fruits and vegetables that have been conducted at the Fort Lewis School of Agriculture, a branch of the State Agricultural College, since the spring of 1916. The work is being conducted primarily to secure information relative to varieties and cultural practices suited for the short growing season in the high altitudes of Colorado. The altitude at the school is slightly more than 7,600 ft., and frosts occur as late as June 10 and as early as September 1.

No definite conclusions are drawn from the orchard work thus far, as the trees, which consist of several varieties of apples, crab apples, plums, and sour cherries, have not come into bearing, with the exception of a few fruits on some of the plums and cherries. Indications are that the chief trouble will be blossom destruction by late spring frosts. Rabbits also cause serious

trouble by eating the bark on scaffold limbs during the prevalence of deep snows. The trees themselves are apparently as hardy as elsewhere in Colorado.

The work with small fruits has been handicapped by poor planting material. Thus far, however, it appears that strawberries should succeed if well mulched with straw in the fall. Raspberries give promise of some success if the canes are covered with earth in the fall. They are apt to suffer from late spring frosts, and the earth cover should be gradually removed in early spring in order to harden the young growth, and also to prevent the development of spindling shoots under the earth cover during a warm spell of weather. Gooseberries and currants appear to be well suited for cultivation in high altitudes, on account of their hardiness and late blooming habits.

Successful crops of various vegetables have been grown for four years, and desirable varieties of each are indicated, including cultural suggestions.

Northern circumpolar work in horticulture, N. E. Hansen (*Minn. Hort., 48 (1920), No. 10, pp. 306–310*).—A summarized account of investigations conducted by the author and others in breeding hardy fruits.

Report of the horticulturist, T. B. McClelland (*Porto Rico Sta. Rpt. 1918, pp. 10, 11, 12–14, pls. 2*).—A progress report on work with vanilla, coffee, cacao, and mangoes (E. S. R., 40, p. 42) and on tests of beans, pigeon peas, and miscellaneous introductions.

The main features of the work conducted with vanilla for several years have been reported in Bulletin 26 (E. S. R., 41, p. 45). In view of the fact that covered sections of the vanilla vine often rot, aerial propagation was tested by simply tying cuttings to a support and leaving them wholly unconnected with the ground. While roots were generally produced by cuttings so placed in from one to seven months' time, their development was much slower than when several nodes of the cuttings were covered with leaf mulch. After the aerial roots entered the mulch the subsequent development of the cutting was entirely normal. Very pronounced effects on the weight and length of the pod were secured in relation to heavy or light pollinations. With the production of an increased number of pods there resulted a decrease in weight per pod but an increase in weight of total production. Individual plants produced pods to the equivalent of 2 lbs. of cured beans. Two small seedlings were secured from crossing two forms received from the Office of Seed and Plant Introduction of the Department.

The transplanting experiment with coffee (E. S. R., 37, p. 649) continued to show by the past season's crop, three years after transplanting, a difference of 10 per cent in favor of the group transplanted from the nursery with roots encased in a ball of earth. Individual crop records are being kept on promising trees of *Coffea dewevrei*. The tree making the maximum growth and giving the maximum yield produced in the past season at a little more than six years from seeding, 23.4 liters of coffee cherries. The cup quality of this coffee is fair but does not equal that of Porto Rican coffee. In several cooperative fertilizer experiments on coffee plantations the 1917 crop showed no effect from nitrate of soda applied in varying amounts in February, August, and December, 1916. The fertilizer test which has been carried on at the station for eight years continued to show the advantage of complete over partial fertilization. Fertilizers carrying nitrogen and either potash or phosphoric acid were superior to those omitting nitrogen. The check plat was inferior to any of the fertilized plats.

The varieties of imported mangoes fruiting during the year are briefly discussed. The seedling trees of Cambodiana which have fruited show that, while no assurance can be had of securing seedling fruit true to type, the chances are good for securing either such fruit, or, if different, fruit with a pleasing flavor.

Several test plantings were made of nineteen varieties of beans from the mainland of the United States, and in addition Santo Domingan, Venezuelan black, Porto Rican red, and Porto Rican white beans. The leading varieties with reference to earliness and yield are discussed. Generally speaking, the Venezuelan black and Porto Rican white beans have given best results under the very unfavorable conditions produced by heavy rains, under which many succumb entirely. A number of selected strains of pigeon peas are also being tested.

In the test plat for miscellaneous introductions the following plants are proving to be well adapted to local conditions: *Flacourtia gardneri*, *Uvaria rufa*, *Mussænda philippica*, and the sugar palm.

Report of the assistant in plant breeding, W. P. SNYDER (*Porto Rico Sta. Rpt. 1918, pp. 18–20*).—Breeding work in 1918 was interrupted on account of the author's absence on military duty. As the result of previous work, two distinct strains of the black Venezuelan bean have been found. Several selections made from both strains have shown considerable variation in yield, some being very productive. Plantings of unselected seed of the black Venezuelan bean have proved consistently more productive than similar plantings of native, Santo Domingan, and mainland varieties. Data are given on a comparative test of 10 varieties of tomatoes conducted in 1917. New lines of work to be conducted include an attempt to develop disease resistant sugar cane, variety crossing and bud selection with grapefruit, and experiments in the production of vegetable and flower seed.

What it costs to produce tomatoes, H. C. THOMPSON (*Amer. Agr., 106 (1920), No. 23, p. 4*).—A contribution from the New York State College of Agriculture, comprising a summary of the cost of producing tomatoes based upon over 300 complete records secured in Chautauqua and Erie Counties, New York, in 1919.

The average cost of growing, harvesting, and delivering was $182.79 per acre. With the high yield for that season of 9.3 tons per acre, the cost was $19.65 per ton, and the net profit was $9.65 per acre. With the normal yield of 6 tons per acre there would have been a considerable loss.

Orchard management investigations (*Kansas Sta. Rpt. 1919, p. 37*).—Some observations made during the year in connection with orchard management investigations are briefly noted.

During the season of 1918 many growers omitted the Bordeaux and other fungicidal sprays because of the light set of fruit of some varieties. As a rule all such trees carried little or no fruit in 1919, whereas other varieties that had a crop of fruit and were well sprayed with Bordeaux in 1918 carried good crops the following year. Hence it appears that spraying has a cumulative effect. Diseases such as apple scab and apple blotch lessen the vigor of the leaves and leaflets of the fruit spurs. Observations made in the Arkansas Valley on the set of fruit in orchards that were well irrigated during the dry part of the season (1918) indicate that it is the growth made during the latter part of the season that is important for the development of fruit buds of the later varieties.

The control work with blister canker indicates that the principal requirement is an application of an antiseptic dressing of corrosive sublimate. In many instances where cankers were removed in the spring an examination made later in the season showed evidence of the disease, and in such cases a second cutting back and disinfection have been quite effective.

Work in orchard fertilization has shown the beneficial effect of manure in conserving moisture. In the second season after manuring the fruit in the

manured section of an orchard stood the drought much better than in the unmanured section. Pruning investigations continue to show that the combination of summer and winter pruning is more desirable than a single operation.

Training and harvesting berries, J. L. STAHL (*Washington Sta., West. Wash. Sta. Mo. Bul. 8 (1920), No. 7, pp. 98–102, figs. 3*).—Practical instructions are given for training and harvesting raspberries, loganberries, and blackberries.

Bush fruits and their cultivation in Canada, W. T. MACOUN and M. B. DAVIS (*Canada Expt. Farms Bul. 94 (1920), pp. 54, figs. 23*).—A revised edition of Bulletin 56 of this series (E. S. R., 19, p. 340). It brings up to date information relative to varieties and cultural methods. To the bulletin have been added a section on Insects Affecting Bush Fruits, contributed by the entomological branch, and one on Common Diseases of Bush Fruits, by W. H. Rankin.

Blackberries of New England—their classification, E. BRAINERD and A. K. PEITERSEN (*Vermont Sta. Bul. 217 (1920), pp. 3–84, pls. 4, figs. 43*).—A systematic study of the species, hybrids, and blend hybrids of Eubatus (Rubus subgenus) occurring in New England. The study is based upon examination of all available herbaria material and upon studies of the plants as to their distribution and development in the wild, their behavior in garden cultures and controlled plats, the characters of the progeny of supposed natural hybrids, and the behavior of the progeny of wild forms when artificially crossed. Introductory considerations discuss the present systematic status of Rubus, methods used in classifying given plants, hybridity among American Rubi, and hybridity as it affects classification. Keys are then given to the 12 species of New England Eubatus, and also to a number of hybrids and blend hybrids, together with illustrations and descriptions. The systematic arrangement of New England blackberries is also illustrated by a diagram. An additional list is given of hybrids or suspected hybrids which are found in New England, together with a list of cited literature. The descriptions include, in addition to the usual data, information relative to pollen viability, character of seedlings, and relation to cultivated forms.

The effect of fertilizers on blueberries, C. S. BECKWITH (*Soil Sci., 10 (1920), No. 4, pp. 309–313, pl. 1*).—A contribution from the New Jersey Experiment Stations presenting observations on the effect of certain commercial fertilizers applied to several plats of blueberries growing at the Cranberry Substation. The results in general indicate that blueberries are benefited by the application of a complete fertilizer, and that the benefit with reference to yield is greater where a part of the nitrogen is supplied from organic sources than where all of it is furnished as nitrate of soda.

Citrus [in Porto Rico], W. V. TOWER (*Porto Rico Sta. Rpt. 1918, p. 16*).—A brief note calling attention particularly to the greater need of using legumes in the citrus groves of Porto Rico and the benefits derived from central packing houses.

The coconut palm: Its culture and uses, P. J. WESTER (*Philippine Bur. Agr. Bul. 35 (1920), 2. ed., rev., pp. 73, pls. 24, figs. 9*).—A revised edition of the author's paper (E. S. R., 39, p. 646), now presented in bulletin form. Special attention has been given to a revision of the part relative to coconut pests.

Culture and preparation of vanilla, C. CHALOT and U. BERNARD (*Culture et Préparation de la Vanille. Paris: Émile Larose, 1920, pp. 219, pls. 8, figs. 29*).—The successive parts of this work discuss the cultural and commercial importance of vanilla for France and her colonies, the history of the vanilla industry, the botany of the genus, and the chemical composition of vanilla; cultural practices; preparation of vanilla for market; diseases and other

enemies of the vanilla tree; extraction; commerce, production, and consumption of vanilla and legislation. The concluding part contains suggestions relative to different phases of the vanilla industry in need of experimentation, together with a bibliography of vanilla. Appended to the work is a short note on the culture of vanilla under glass.

Propagated hickories, W. G. Bixby (*Amer. Nut Jour., 13 (1920), No. 5, pp. 70, 71, fig. 1*).—A paper delivered before the Northern Nut Growers' Association, October 8, 1920, in which the author discusses several instances of successful hickory grafting.

Some of the older varieties of pecans of Texas origin, F. T. Ramsey (*Amer. Nut Jour., 13 (1920), No. 5, pp. 67, 68, fig. 1*).—An enumeration of some 50 varieties of pecans, including information relative to their origin and brief notes on their distinguishing characteristics.

Some precautions in top-working pecan trees, J. B. Demaree (*Amer. Nut Jour., 13 (1920), No. 5, p. 74*).—In this paper particular attention is given to the necessity of thoroughly protecting large wounds, caused by cutting back for top-working, from the attack of wood-rotting fungi. For this purpose, the author recommends a mixture of one part creosote and two parts coal tar, to be followed within two or three months by a heavy application of coal tar.

Experiments with gladiolus cormels, " buds " of corms, and corms cut in pieces, C. E. F. Gersdorff (*Flower Grower, 7 (1920), No. 12, pp. 202, 203*).—At the beginning of the season of 1919 peeled cormels of 59 varieties of gladioli were planted in paper pots and kept in sunny windows.

A wide range in this time of germination was observed both between varieties and within varieties. A few varieties failed to produce any foliage but yielded corms for every cormel planted. One variety failed to germinate by harvest time, and the cormels were immediately planted outside where they remained all winter with a light covering of leaves, springing into growth the following season.

Neither germination by buds with a part of the corm adhering nor germination of corms cut to pieces containing one eye each and with a part of the base of the corm proved satisfactory methods for increasing stock.

Propagation of the Madonna lily, D. Griffiths (*Flower Grower, 7 (1920), No. 12, p. 199*).—A contribution from the U. S. Department of Agriculture comprising directions for propagating the Madonna lily (*Lilium candidum*) from seed, scales, stems, and bulbs.

Our trees and shrubs, B. Plüss (*Unsere Bäume und Sträucher. Freiburg i. Breisgau: Herder's Pub. Co., 1919, 8.–9. rev. ed., pp. VII+132, figs. 157*).—A revised edition of this work which comprises a small guide for the determination of the principal trees and shrubs of Europe based upon leaves, flowers, and buds.

The tché (Cudrania triloba), F. Lambert and P. Péronne (*Ann. École Nat. Agr. Montpellier, n. ser., 17 (1918–19), No. 2, pp. 86–104, figs. 10*).—An account of this Chinese tree, with reference to its botanical characters and uses and propagation.

The tché, or ché tree, is used primarily as a substitute for mulberry in silkworm culture. It is also valuable as a hedge plant, and the roots yield a reddish-yellow coloring matter.

FORESTRY.

Forests and trees, B. J. Hales (*Toronto: Macmillan Co. of Canada (Ltd.), 1919, pp. IX+205, pl. 1, figs. 72*).—A popular work written with the view of creating a healthy public opinion regarding the use and care of trees. Part 1 discusses the forests and life, the value of forests, forest devastation, forest

preservation from the standpoints of organization and administration, tree growing, the tree plantation on the prairie farm, and Canadian forests. Part 2 contains descriptive accounts of the principal forest families and species.

A manual of the timbers of the world, their characteristics and uses, A. L. HOWARD (*London: Macmillan & Co., 1920, pp. XVI+446, figs. 119*).—A handbook of information concerning all the timbers encountered in commerce, including those which have only of recent years appeared in the European market. The subject is treated from its commercial, technical, and industrial aspects. Appended to the manual is an account by S. Fitzgerald on the artificial seasoning of timber.

Bavarian willows, A. TOEPFFER (*Ber. Bayer. Bot. Gesell., 15 (1915), pp. 17–233*).—A monograph on the Bavarian willows with reference to the species of Central Europe. The subject matter is presented under the general headings of the morphology and biology of the genus Salix; key for the determination of Central European species of willows; systematic descriptions of the Central European species and their hybrids, and of the Bavarian species and their hybrids; and a chronological record of willow investigations in Bavaria from 1587 to 1914.

Factors controlling the distribution of forest types, II, G. A. PEARSON (*Ecology, 1 (1920), No. 4, pp. 289–308, figs. 3*).—In a previous paper the author dealt with the measurement of soil and climatic factors in each forest type studied in the San Francisco Mountains in Arizona (E. S. R., 44, p. 46). In the present paper the range of each of the coniferous species of the locality is discussed from the standpoint of limiting factors, and certain conclusions are reached relative to the factors limiting the distribution of the different species and types.

The weight of evidence thus far accumulated supports the hypothesis that the upper altitudinal range of all tree species in the region studied is determined by low temperature, primarily as related to photosynthesis. This conclusion does not ignore the part played by winterkilling resulting from excessive water loss at times when low soil temperature, through lack of sufficient snow cover in places, renders the moisture unavailable to the roots. The lower altitudinal range of all tree species is apparently determined by deficient moisture, although the effects of high temperature and low moisture are to a large extent inseparable. It was found by actual test with Engelman spruce, which reaches its extreme lower altitudinal limit at about 9,000 ft., that increased water supply will enable the spruce to grow in temperatures as high as those experienced in the yellow pine type at 7,500 ft. These tests are being continued with the view of securing conclusive data.

Contribution on the subject of late frost, W. SCHADELIN (*Schweiz. Ztschr. Forstw., 71 (1920), No. 11, pp. 329–344, pls. 2, figs. 2*).—Observations are given on the relative frost resistance of various forest species, including suggestions for remedying frost injury in new plantings of susceptible species.

Live-stock grazing as a factor in fire protection on the National Forests, J. H. HATTON (*U. S. Dept. Agr., Dept. Circ. 134 (1920), pp. 11, pls. 5, fig. 1*).—A contribution from the Forest Service. The author presents evidence to show that normal grazing is an important factor in forest-fire protection, and suggests methods of extending the application of the protective features of grazing in National Forest fire-protection plans, especially at critical or strategic points.

The Washington National Forest (*U. S. Dept. Agr., Dept. Circ. 132 (1920), pp. 10, figs. 26*).—A popular circular emphasizing the scenic and vacation features of the Washington National Forest.

Reforestation in Massachusetts, J. R. Simmons (*Boston: State Forester, 1920, pp. 19, pls. 8*).—The present edition of this bulletin (E. S. R., 22, p. 739) has been undertaken with the view of bringing the experience and practice in reforestation up to date, after having observed during the last ten years the trees grown in experimental plantations and the effects produced by soil and location in different parts of the State.

The utilization of German forests during the war, M. Büsgen (*Jahresber. Ver. Angew. Bot., 14 (1916), No. 1, pp. 1–22*).—This is a brief review of German investigations during the first two years of the world war, dealing with the utilization of the native forests and forest products.

The exploitation of the forests and the timber trade from 1914 to 1919, M. Decoppet and A. Henne (*L'Exploitation des Forêts et le Commerce des Bois de 1914 à 1919. Berne Dépt. Féd. Int., Insp. Forêts, 1920, pp. 117, pls. 4*).—A review of the timber cut and the timber trade in Switzerland from 1914 to 1919, including a general sketch of the economic measures necessitated by the war.

Timber supply after the war, A. Serpieri (*R. Ist. Super. Forestale Naz. Firenze* [*Pub.*] *No. 1 (1919), pp. 26*).—A review of lumber conditions in Italy previous to and during the war, including suggestions for the development of an adequate supply of timber at the present time.

Progress of forestry in China, J. H. Reisner (*Amer. Forestry, 26 (1920), No. 323, pp. 655–658, figs. 5*).—A contribution from the University of Nanking, describing recent afforestation activities in China. The author points out that, in marked contrast to forestry in western countries, forestry in China is being developed by the lower and smaller political units, agricultural societies, agricultural and forestry companies, and individuals, whereas the central Government is doing practically nothing along this line.

Progress report of forest administration in the Province of Assam for the year 1918–19, A. W. Blunt and F. H. Todd (*Assam Forest Admin. Rpt., 1918–19, pp.* [*99*], *pl. 1*).—The usual progress report on the constitution, administration, and management of the State forests of Assam (E. S. R., 41, p. 652). Detailed data relative to alterations in forest areas, forest settlements, surveys, working plans, forest protection, silvicultural operations, yields in major and minor forest products, revenues, expenditures, etc., are appended.

Progress report of forest administration in Coorg for the year 1918–19, H. C. Bennett (*Coorg Forest Admin. Rpt., 1918–19, pp.* [*32*]).—A report similar to the above relative to the State forests in Coorg (E. S. R., 41, p. 652).

Progress report on forest administration in the Punjab for the year 1918–19, W. Mayes (*Punjab Forest Admin. Rpt., 1918–19, pp.* [*36*]+*CXIII, pl. 1*).—A report similar to the above relative to the State forests in Punjab for the year 1918–19 (E. S. R., 41, p. 744).

Annual report on the forest administration of Nigeria for the year 1918, H. N. Thompson (*Nigeria Forest Admin., Ann. Rpt. 1918, pp. 9*).—A brief report on the administration of the forests in Nigeria with data on forest and plantation areas, exploitation, revenues, expenditures, etc.

DISEASES OF PLANTS.

Plant pathology investigations (*Wisconsin Sta. Bul. 319 (1920), pp. 26–38, figs. 8*).—Summary accounts are given of investigations on plant diseases conducted at the Wisconsin Station.

A study was made by E. D. Holden of the influence of air and soil temperatures as well as soil moisture condition on the development of the parasite of barley stripe. As a result of the experiments it was found that the earliest

plantings were most highly infected, and that infection grew less as lateness of planting progressed.

In experiments by G. W. Keitt for the control of the cherry leaf spot, the comparative merits of Bordeaux mixture and lime sulphur were investigated. It was found that both preparations control the disease satisfactorily and with approximately equal efficiency. Bordeaux mixture (3:3:50) and lime sulphur (1:40 solution), in two applications, the first when the petals had fallen and the second about two weeks later, were found to control the disease.

An account is given of the apple scab and its control, in which it is reported that the discharge of the spores capable of producing the disease was found by Keitt to occur almost exclusively during or shortly after rainy weather. Spraying experiments with Bordeaux mixture and lime sulphur, both in dry and liquid form, were carried on, but in no case did the standard schedule of four treatments satisfactorily control the disease. Where an additional application was made as soon as the small blossom buds were exposed to infection but before they separated, it was possible to control the disease with each of the fungicides used.

Experiments on the control of rye ergot showed that by the use of salt brine for separating the ergot from the seed the disease may be eliminated, provided proper crop rotation is observed.

For the control of wheat scab it is claimed that experiments by A. G. Johnson and J. G. Dickson indicate that by treating clean seed with formaldehyde and planting such seed on thoroughly plowed land where cornstalks, grain, and grass stubble have been covered, satisfactory results can be secured.

Studies conducted on the relation of barberry to wheat rust are said to indicate that in extraordinarily mild winters the spores of the black stem rust may winter over on winter grains and grasses. Consequently, the eradication of the barberry is not regarded as sufficient to eliminate entirely this disease.

A brief note is given on the bacterial disease of soy beans previously noted by F. M. Coerper (E. S. R., 42, p. 352), and attention is called to the fact that the disease is readily borne on the seed. This is said to make necessary seed selection, and it is also hoped that freedom from disease may be obtained through the development of disease-resistant types.

Notes are given on the improved types of cabbage resistant to yellows that have been developed by the station, and on seed disinfection for blackleg and black rot of cabbage. The use of dry heat for disinfecting seed was not wholly satisfactory. Experiments have indicated that where hot-bed sash was used over young plants the dissemination of the disease could be practically checked, but this method is not considered practicable under commercial conditions. The most feasible method of control is believed to be the growing of seed under conditions where this disease does not occur.

A report is given of the investigations on the influence of soil temperature on black scurf of potato. The disease was found by B. L. Richards to develop to the greatest extent at a temperature of 64° F., but was pronounced in its development through a range of 68 to 70°. More injury was reported on the experimental plat in 1918, when the soil had a temperature of 66°, than in 1919 when the temperature for the same period averaged 71°.

Notes are given on several tobacco diseases, among them a Fusarium disease which has been previously described by J. Johnson (E. S. R., 42, p. 247), a new bacterial spot disease locally known as rust, and the must of cured tobacco caused by *Oospora nicotianæ;* the development of root rot resistant tobacco; root rot investigations as affecting the value of land; the relation of crop rotation to tobacco root rot; and tobacco seed improvement. In the work

on the development of root rot resistant tobacco it has been found that resistance to the disease is apparently a dominant characteristic. Several strains have been developed which are resistant to the disease, and seed was distributed to a number of growers in the State. An investigation on the effect of tobacco on land has shown that the value of worn-out or run-out tobacco soils is not reduced on account of the effect of the crop, but rather that poor yields are to be attributed to the occurrence of root rot. In connection with the crop rotation work it has been found that clover or alfalfa can be grown in conjunction with tobacco without danger from infection from root rot, but that tobacco should not follow cowpeas.

A brief account is given of investigations by G. F. Potter on root hardiness of seedling apple roots. It has been claimed that an extended freeze is more injurious than a short one of even slightly greater severity, and experiments were conducted to determine the effect of the rapidity of freezing and the duration of minimum temperature. The results obtained indicated that a rapid freeze was no more injurious than a slow one. In the freezing of the roots, the minimum temperature reached is apparently the most important factor. In attempting to locate the exact point of injury caused by freezing, over 2,000 apple-tree seedlings were subjected to freezing tests after which they were planted in the greenhouse. The results of this work indicate that the initial injury to the roots appears in the immature cells of the xylem just within the cambium or growing layer. When roots are somewhat more seriously affected, browning of this tissue and also of the immature phloem cells is visible. The cambium or growing layer appears to be more hardy than either the inner or outer tissues. Injury to the cambium was never found unless injury to the other tissues was present.

Diseases of plants (*Kansas Sta. Rpt. 1919, pp. 39–41*).—Brief summaries are given of a number of plant diseases that have been under observation, the principal investigations being confined to diseases of cereals, especially wheat and corn.

Additional notes are given on a biological form of stem rust previously described (E. S. R., 39, p. 454). This rust has again been found to attack a number of otherwise resistant varieties of winter wheat.

Leaf rust as it occurs in Kansas is said to attack Kanred and a few other winter wheats very lightly, infection for Kanred in 1919 being less than 10 per cent. In corn-smut investigations it was found that the fungus could be isolated from the air a number of weeks before corn was planted, indicating that there is a possibility of more or less constant infection throughout the growing season. Sprays applied to the corn plant were found to reduce the smut but also the yield, and it is believed that the reduction of smut is probably due to reduced plant surface rather than to actual fungicidal control.

Notes are given on the root rot of corn due to *Fusarium* sp., a barberry survey in Kansas, the treatment of seed potatoes with corrosive sublimate solution to prevent scurf and blackleg, and the occurrence of apple-tree canker due to *Leptosphæria coniothyrium*. This fungus is said to be identical with that causing the raspberry cane blight, and it is thought advisable to keep raspberry bushes away from young orchards.

Cause of lime-induced chlorosis and availability of iron in the soil, P. L. Gile and J. O. Carrero (*Jour. Agr. Research [U. S.], 20 (1920), No. 1, pp. 33–62, pls. 2*).—A report has been given of a study of chlorosis of pineapple occurring on certain soils in Porto Rico (E. S. R., 26, p. 121). Additional work has been carried on to determine the manner in which carbonate of lime induces chlorosis in the plant. Experiments were conducted with rice, which

has been found quite susceptible to chlorosis. Soil surveys showed that a particular type of chlorosis affects plants only on calcareous soils, although all calcareous soils do not induce chlorosis. The addition of carbonate of lime to soils producing normal, calcifugous plants caused the production of chlorotic plants, from which it is concluded that the chlorosis of some plants is caused by, or associated with, the presence of carbonate of lime in the soil.

From evidence obtained from ash analyses of chlorotic plants, the authors were led to consider a deficiency of iron as one of the causes of chlorosis, with possibly an excess of lime as a contributory cause. The treatment of chlorotic plants with iron showed that a lack of iron is at least one of the causes of lime-induced chlorosis. This form of chlorosis is considered due simply to a depression in the availability of iron in calcareous soils. Organic iron compounds added to the soil proved inefficient as sources of iron for rice. However, the application of bulky organic compounds such as stable manure, velvet bean plants, and tobacco stems, when used in considerable quantities, enabled the plants to secure more iron. The availability of iron in calcareous soils is said to be slightly greater near the optimum water content of the soil than at higher percentages of moisture.

The authors report that although rice becomes chlorotic in calcareous soils with ordinary percentages of water, it will grow normally in certain calcareous soils if the soil is submerged. This is believed to be due to the production under submerged conditions of a type of root that is better able to assimilate iron than roots formed in soil with a lower water content.

Employment of Uspulun for seed treatment, T. Gregorovius (*Möller's Deut. Gärt. Ztg., 33 (1918), No. 21, pp. 167, 168*).—Results are given in tabular form with discussion of tests with garden plants of Uspulun as a seed treatment.

Dusting v. spraying, R. D. Bligh (*Fruit Growers' Assoc. Nova Scotia, Ann. Rpt., 54 (1918), pp. 191, 192*).—Tests conducted by the Experimental Station, Kentville, N. S., in 1917 to ascertain the relative efficiency of sulphur dust as compared with the regular lime-sulphur spray appear to show that under the seasonal conditions of that year the dust was fully as efficient a fungicide, though these results are not considered as conclusive. The dust spray gave better control of insects and caused less injury to the foliage. The cost of material for the dust spray was very much greater, but this was offset by a much smaller cost in application and by the greater rapidity with which the work can be done.

Fusarium blight (scab) of wheat and other cereals, D. Atanasoff (*Jour. Agr. Research [U. S.], 20 (1920), No. 1. pp. 1–32, pls. 4, figs. 2*).—A preliminary report is given of the headblighting of wheat, spelt, rye, barley, and oats, as caused by *Gibberella saubinetii*. This organism is said to attack the hosts in two different ways, producing two distinct pathological conditions. The first result is caused by an attack on the root systems and the bases of the young and later of the grown plants, while the second condition results from an attack upon some of the parts above ground. The latter may result in a rotting of the nodes of wheat, rye, and barley, or blighting of the heads of wheat, spelt, rye, barley, and, less commonly, of oats and certain grasses.

The present report gives little attention to the root rot but is confined to the headblighting of cereals. The geographic distribution, economic importance, and characteristics of the disease are described, after which the author gives an extended account of the life history of the causal organism in relation to pathogenesis. More than 30 varieties of wheat were tested at the Wisconsin Experiment Station and all were attacked more or less by headblight. Some

evidence, however, was obtained to indicate differences in varietal susceptibility to this fungus.

A Helminthosporium disease of wheat and rye, L. J. Stakman (*Minnesota Sta. Bul. 191 (1920), pp. 4–18, pls. 5*).—The author reports a destructive disease of wheat caused by Helminthosporium as being under observation for a number of years. Common wheats, durum, and club wheats, emmer, einkorn, and rye are susceptible to infection, and many grasses were also found easily infected. The blight was found to attack practically all parts of the plant, and the disease is considered to be seed-borne. Seedling blight almost always resulted from sowing diseased seed. Secondary infections occurred on the leaf, culm, and head. A strain of the causal organism which has been isolated from rye was found to infect wheat, barley, and several grasses.

For the control of this disease the author recommends the use of seed from uninfected fields and good cropping methods. While the blight is said to be due to a species of Helminthosporium, it is not considered identical with the foot rot described from Illinois (E. S. R., 43, p. 445) or from other countries. The partial or almost complete recovery of many of the seriously injured seedlings is said to suggest that the disease need not cause undue apprehension on the part of wheat growers.

A new wheat disease (*Fla. State Plant. Bd. Quart. Bul., 3 (1919), No. 3, p. 124*).—"Take-all" is said to be very destructive to wheat in Illinois and elsewhere in the Middle West. It is supposed to have been introduced by the planting of Australian wheat imported for food purposes.

Diseases of alfalfa and clover due to Macrosporium sarciniforme, G. Gentner (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 16 (1918), No. 9–10, pp. 97–105, figs. 2*).—A brief account is given of the morphology, biology, and pathology of *M. sarciniforme*, as studied on clover and alfalfa.

Control of the root, stalk, and ear rot diseases of corn, J. R. Holbert and G. N. Hoffer (*U. S. Dept. Agr., Farmers' Bul. 1176 (1920), pp. 24, figs. 26*).—A popular description is given of rot diseases of the root, stalk, and ears of corn, which are said to be caused by several organisms and probably by other contributing factors. The presence of these diseases, it is claimed, may be recognized in germination tests and in the fields by symptoms which are described.

The occurrence of the rots may be controlled to a large degree by the selection of well-matured seed from healthy plants, curing and storing the seed in well ventilated places, and discarding all ears which show rough denting of the grain, pink, discolored, cracked, or shredded shank attachments, or moldy, discolored, or starchy kernels. Special germination tests are recommended for each seed ear selected for planting.

Potato diseases in Minnesota, G. R. Bisby and A. G. Tolaas (*Minnesota Sta. Bul. 190 (1920), pp. 5–44, figs. 28*).—Descriptions are given of the various diseases observed in Minnesota, with suggestions for their control, the bulletin being practically a revision of Bulletin 158 previously noted (E. S. R., 35, p. 652).

Diseases of the potato, P. A. Murphy (*Fruit Growers' Assoc. Nova Scotia, Ann. Rpt., 54 (1918), pp. 180–190*).—Dividing potato diseases into two main classes, those which are caused by a wind-borne parasite and those which are constitutional in their nature, the author gives a discussion of both phases in some detail.

Leaf roll is said to be by far the most common and most important constitutional disease of the potato in the Annapolis and Cornwallis Valleys. It is stated that the average increase in yield in all spraying experiments during the

last three years for blight has been a little less than 100 bu. per acre. Four applications are sufficient as a general rule.

The use of Bordeaux mixture for spraying potatoes, G. R. BISBY and A. G. TOLAAS (*Minnesota Sta. Bul. 192 (1920), pp. 4–32, figs. 4*).—The authors have compiled the results of spraying experiments carried on at the station for a number of years, from which it appears that the average increase in yield from spraying in the absence of late blight has been more than 30 bu. per acre for late varieties and about 27 bu. for early varieties. The most satisfactory formula for use is said to be the 5:5:50 Bordeaux mixture. Equally satisfactory results were reported from several substations as well as from cooperative tests under farm conditions. For large acreage the authors recommend the use of home-made Bordeaux mixture on account of its lower cost.

Spraying for late blight of potatoes, O. R. BUTLER (*New Hampshire Sta. Circ. 22 (1920), pp. 3–6*).—Data are given regarding the cost of spraying potatoes with Bordeaux mixture and the increased returns received. The author recommends a thorough spraying of potatoes with Bordeaux mixture, an 8:4:50 solution applied every two weeks being considered better as a protection from late blight than either a 4:4:50 or a 4:2:50 mixture applied every week.

The potato wart disease, H. E. STEVENS (*Fla. State Plant Bd. Quart. Bul., 3 (1919), No. 3, pp. 116–120*).—The potato wart disease (*Chrysophlyctis endobiotica*) is noted as occurring in Hungary in 1896, in England in 1902, in Germany and Ireland in 1908, in Scotland and Wales afterwards, in Newfoundland in 1909, and in Pennsylvania in 1918. An account is given also of the activity in 1912 of the Federal Quarantine Board and of other protective measures.

Four cities in Florida—Jacksonville, Tampa, Key West, and Pensacola—are known to have received shipments of foreign potatoes about the same time as Pennsylvania. The organism is known to live for six or eight years in the soil after thorough infection.

Apple spraying, G. E. SANDERS (*Fruit Growers' Assoc. Nova Scotia, Ann. Rpt., 54 (1918), pp. 72–92*).—In an account of the spraying work of 1917, it is stated that one man spraying from the ground up through the trees did serious damage to the foliage, while the other man spraying from the top of the outfit with the same solution caused no injury. It was found that the 1:30 lime-sulphur solution in laboratory tests wet only the upper side of the apple leaves, and that no injury would result when the lower side was not reached by the spray. Spraying with soluble sulphur and Bordeaux mixture on the under side of the leaf apparently caused no more harm than the same solution applied to the upper side. The burning which followed the application of lime sulphur to the under side of the leaf appeared first on the upper side which was untouched by the spray.

An extract of chlorophyll from the leaves was tested with lime sulphur, which caused a sudden change in the green solution, throwing down a brown precipitate, while the soluble sulphur and Bordeaux mixture showed no marked change. On sectioning the leaves and putting them under the microscope the lime sulphur was found to be absorbed by the leaves, causing a marked change and browning of the chlorophyll in the palisade tissues. The soluble sulphur and Bordeaux caused no apparent change in leaf chlorophyll, which is mostly contained in the upper or palisade cells of the leaf.

It is thought that the increase in the size, pressure, and nozzle capacity of the power spraying outfits has been largely instrumental in causing the increased amount of burning in recent years, the high pressure having a tendency to wet the under side of the leaf more thoroughly. It appears from the 1917 work that the direction from which the spray was applied was far more important than the strength of the solution.

Studies on the effect of light in this connection showed that plants kept for a period in darkness would burn more readily than those kept in full sunlight. The explanation offered is that chlorophyll is not manufactured in the absence of sunlight, and the depletion of chlorophyll following a period of darkness results in more serious injury in this case.

Regarding leaf injury or bronzing from Bordeaux mixture, it is stated that one spraying with the 4:4:40 mixture will not usually cause appreciable bronzing, but that three or four applications may cause serious bronzing, yellowing, and defoliation. As regards the admixture of poisons, it was found in 1917, as in previous years, that arsenate of lime is slightly safer than arsenate of lead with lime sulphur and that it costs only about half as much per unit content of arsenic.

The spray gun is considered the most valuable labor-saving device for the application of spray, though injury is likely to follow its use on account of the increased amount of lime sulphur reaching the under side of the leaves.

Bitter pit and water core of the apple, A. Frank (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 7, pp. 110–112*).—Descriptions are given of bitter pit and water core, two diseases of the apple which are in some way dependent upon the water relationship of the plants. For controlling these troubles the author recommends proper pruning, so as to maintain a regular crop of evenly distributed fruit, and thinning when necessary. For water core, attention should be given to the care of the trees in order that the foliage may be maintained in a high state of health. It is claimed that apples affected with water core frequently overcome the trouble if placed in good storage.

Dominion experimental orchard work in 1917, M. P. Pike (*Fruit Growers' Assoc. Nova Scotia, Ann. Rpt., 54 (1918), pp. 145–166*).—It is found that injuries characteristic of Bordeaux sprays appear wherever they are applied under climatic conditions similar to those of Nova Scotia. Lime-sulphur spray gives a much better finished product, and it is thought that a method of application will probably be found whereby the burning of foliage will be practically eliminated.

Tests have been conducted during the past four years for the purpose of ascertaining which of the four regular sprays are the most important. A summary of these and the previous experiments is given herein. It appears evident that no one spray will suffice, but it is thought that it may be possible to control scab fairly well by two thorough applications. Two sprays before the blooming period are of more value than two given afterwards. If three sprays only are to be given, the fourth is the one to be omitted as a rule.

A summary of the results of spraying at different strengths would seem to indicate that it is not possible to eliminate burning, especially in the heavy applications, by reducing the strength of the mixture. However, observations made during the previous three years led to the belief that much of the drop attributed to the lime sulphur is due to some other cause. The result of tests to determine the relative efficiency of Bordeaux mixture as compared with lime sulphur in the fourth spray, as a fungicide for scab control, would seem to show no advantage and more foliage injury where Bordeaux is used. Lime-sulphur sprayed apples have a finer finish than those sprayed with Bordeaux mixture, which causes injury to the green colored fruits such as the Fallawater and Greening, in the form of small russet dots scattered over the surface.

Tabulated data are introduced to show that lime sulphur alone may cause the burning of foliage. Tests with arsenate of lead seem to show that there is some fungicidal value in the spray, but more yellowing of the foliage appears in the plats receiving this treatment unless hydrated lime is added to the arsenate of lead. Additional tests made with soluble sulphur arsenate sprays seem to

bear out previous experiments in that more yellowing and burning are likely to result from its use than from regular lime sulphur sprays.

Among the general conclusions from this work is the statement that lime-sulphur arsenate is a more satisfactory spray than Bordeaux arsenate. Nozzles do not appear to be a factor in scab control provided the work is thoroughly done, though rapidity of the work may render the adoption of calyx and drive nozzles advisable. The experiments seem to indicate that lime sulphur is as satisfactory a spray as any for the control of apple scab. However, the two sprays after blooming should be put on in a strength weaker than that generally used, and with less force, using the regular spray nozzle. For lime-sulphur a 1:40 strength is recommended with arsenate of lead paste, 5 lbs. to 100 gals., or 1.5 lbs. arsenate of lime for the sprays before bloom, and 1:50 or 1:60 lime sulphur with 3 to 5 lbs. arsenate of lead paste, or 1 to 1.5 lbs. arsenate of lime, for the spray put on after blooming. Unless weather conditions are very favorable for scab the last spray, as used in 1918, may be eliminated.

Diseases of apples in storage, C. Brooks, J. S. Cooley, and D. F. Fisher (*U. S. Dept. Agr., Farmers' Bul. 1160 (1920), pp. 24, figs. 27*).—The authors describe the various diseases which are liable to occur on apples in storage and suggest methods for their control. Particular attention is given to scald, which is a serious transportation and storage disease. For the control of this disease ventilation is said to be as important as low temperature, and in storage rooms ventilation is highly important. Apples are said to scald far less when in boxes, baskets, or ventilated barrels than in tight barrels, and wrapping apples in oiled paper is said to furnish the most complete protection against scald.

The banana disease, J. Matz (*Porto Rico Dept. Agr. and Labor Sta. Circ. 25 (1920), Spanish ed., pp. 3–7*).—A popular account is given in Spanish of the disease of bananas due to *Fusarium cubense* (E. S. R., 38, p. 757).

The watery or Monilia disease of cacao pods (*Agr. News [Barbados], 19 (1920), No. 470, pp. 142, 143*).—The description here furnished is said to have been taken from a handbook by Rorer, previously noted (E. S. R., 39, p. 544; 40, p. 158).

Control of coffee leaf disease, T. B. McClelland (*Porto Rico Sta. Rpt. 1918, pp. 11, 12*).—A brief statement is given regarding investigations carried on by the station on the control of coffee leaf disease due to *Stilbella flavida*.

Papaya leaf blight, H. E. Stevens (*Fla. State Plant Bd. Quart. Bul., 4 (1920), No. 3, pp. 98–100*).—A leaf blight of *Carica papaya* has recently been reported to the State plant board from St. Cloud, Fla., the source being unknown. Affected leaves begin to dry up at the edges as if scorched. The disease has been reported previously from Porto Rico, Cuba, British Guiana, and Sanibel Island, but so far as known it has not appeared elsewhere in Florida. It is said to be caused by *Pucciniopsis caricæ*, and its appearance is described.

Tentative recommendations as regards control include three or four sprayings with Bordeaux mixture at a strength of 3:3:50 at intervals of ten days to two weeks, care being taken to cover thoroughly both under and upper sides of the leaves. In case of severe attacks all of the older infected leaves should be removed and destroyed. Severely infected young plants may be more economically removed.

An attempt to control walnut blight, H. S. Fawcett and L. D. Batchelor (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 5–6, pp. 172–178, figs. 3*).—Blight or bacteriosis (*Pseudomonas juglandis*) is said to be one of the most serious diseases of Persian walnuts in California.

An attempt was made during 1915–16 to control walnut blight in two different orchards by the elimination of hold-over twig lesions, followed by thorough spraying. A detailed account is given of the work, the results of which were negative.

Plant cancer (*Missouri Bot. Gard. Bul., 7 (1919), No. 5, pp. 51–53, pls. 3*).—A descriptive discussion is given of a destructive disease of marguerites, or Paris daisy (*Chrysanthemum frutescens*), in the Missouri Botanical Garden and elsewhere, including a brief account of the history of this disease, caused in plants by *Bacterium tumefaciens*, and of its hosts as herein listed.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Toxicity of barium carbonate to rats, E. W. SCHWARTZE (*U. S. Dept. Agr. Bul. 915 (1920), pp. 11*).—This paper summarizes previous investigations of the toxicity of barium salts and reports the results of experimental work conducted.

"The lethal dose of barium compounds for rats is as follows: Barium chlorid, subcutaneously, 45 to 89 mg. per kilogram; barium chlorid, by stomach tube, 350 to 535 mg.; barium carbonate, per os, 630 to 750 mg. On the basis of the barium content, the carbonate is about two-thirds as active as the chlorid per os. The average intake of food, both poisoned and unpoisoned, by hungry white rats used in these tests was one one-hundredth of their body weight. Twenty per cent of barium carbonate in the rat bait was found to be an efficient concentration. With this percentage a rat is required to eat only one-third or three-eighths of a meal of average size, or one three-hundred-and-twentieth to one two-hundred-and-sixty-sixth of its own weight, in order to secure the ingestion of a lethal amount. With this concentration many of the rats die within the first 24 hours, the chief factor being the consumption of an amount larger than the minimum efficient lethal dose. From the results of both the pharmacological and the feeding tests, it would not seem advisable to always expect 100 per cent mortality from the administration of barium carbonate, in proper amounts, to rats.

"Apparently rats are about as susceptible to barium administered subcutaneously as rabbits, chickens, and pigeons, and approximately one-third as sensitive as cats and dogs. When the barium is administered by mouth, however, the rat is comparatively the least susceptible of all the mammals cited, although the absolute amount is less, because of the small size of the rat."

A list is given of 20 references to the literature.

Directory of officials and organizations concerned with the protection of birds and game, 1920, G. A. LAWYER (*U. S. Dept. Agr., Dept. Circ. 131 (1920), pp. 19*).—This is the usual annual directory.

Laws relating to fur-bearing animals, 1920, G. A. LAWYER, F. L. EARNSHAW, and N. DEARBORN (*U. S. Dept. Agr., Farmers' Bul. 1165 (1920), pp. 32*).—This is the usual annual summary of laws in the United States, Canada, and Newfoundland, relating to trapping, open seasons, propagation, and bounties.

Seventeenth supplement to the American Ornithologists' Union check-list of North American birds (*Auk, 37 (1920), No. 3, pp. 439–449*).—This is the second supplement issued since the publication of the third edition of the check-list of North American birds in 1910, previously noted (E. S. R., 24, p. 555), of which the first was issued in 1912 (E. S. R., 39, p. 153).

The birds of the British Isles and their eggs, T. A. COWARD (*London and New York: Frederick Warne & Co., Ltd., 1920, pp. VII+376, pls. 159, fig. 1*).—This popular account is illustrated by plates, a large proportion of which are in colors.

The crow in its relation to agriculture, E. R. KALMBACH (*U. S. Dept. Agr., Farmers' Bul. 1102 (1920), pp. 20, figs. 4*).—This is a popular summary of information based upon the author's investigations reported in Bulletin 621, previously noted (E. S. R., 38, p. 856).

Observations on the effect of storm phenomena on insect activity, D. C. PARMAN (*Jour. Econ. Ent., 13 (1920), No. 4, pp. 339–343*).

Injurious insects and other pests (*Kansas Sta. Rpt. 1919, pp. 41–48*).—In reporting upon investigations under way during the year, reference is made to the work with (1) the Hessian fly, a bulletin upon which is being published; (2) the corn earworm, an account of which by McColloch has been noted (E. S. R., 43, p. 358); (3) fruit insects, including the apple-leaf skeletonizer and the transmission of raspberry cane blight by insects; (4) miscellaneous insects injurious to staple crops, including root injury by *Lachnosterna* spp., a report of investigations of which by Hayes has been noted (E. S. R., 43, p. 760), and insects injurious to alfalfa, including three hay worms, namely, the meal snoutmoth (*Pyralis farinala*) which is the most common, the true alfalfa hay worm (*Hypsopygia costalis*), next in importance, and an unidentified species, the garden webworm, the cotton cutworm (*Prodenia ornithogalli*), and cooperative control work with the grasshopper, an account of which by Flint has been noted (E. S. R., 43, p. 353). The cotton cutworm is said to have been generally present over the State. In one alfalfa field of about 30 acres, near Manhattan, which was being saved for seed, it caused an injury of at least 50 per cent.

Report of the State entomologist, A. F. CONRADI (*Clemson Agr. Col. S. C., Bd. Trustees Ann. Rpt., 30 (1919), pp. 152–168*).—This report deals with intra and interstate nursery inspection, sweet potato and cotton boll weevil quarantine, the pink boll worm, European corn borer, etc.

[Work with insects] (*Wisconsin Sta. Bul. 319 (1920), pp. 62–65, figs. 4*).—A brief account is given of investigations of the pea moth in Wisconsin, a bulletin relating to which, by Fluke, has been noted (E. S. R., 43, p. 257).

Brief reference is also made to control work with the potato leaf-hopper, a report of investigations of which pest in Wisconsin by Ball has been previously noted (E. S. R., 41, p. 847). Applications of Bordeaux mixture by a wheelbarrow sprayer with a pressure of 100 to 150 lbs. and the spray projected on the under side of the foliage gave an increased yield of from two to three times that of the untreated area. It is concluded that Bordeaux mixture, 4 : 4 : 50, alone or, better, in combination with nicotin sulphate 1 : 1,200, will protect potato plants from bad infestation by the leaf-hopper and the diseased condition of the potato foliage for which the leaf-hopper is responsible. Investigations of its natural enemies indicate the presence of a fungus disease attacking both adults and nymphs and of an egg parasite.

During the year the green clover worm, often a serious pest on alfalfa, was found by L. G. Gentner to be a serious menace to certain garden crops, particularly garden beans. Many were killed by parasites during the latter part of August and early September. Spraying the bean plants with arsenate of lead at the rate of 1 to 1.5 lbs. to 50 gal. of water is said to control the pest.

While the strawberry crown miner has not been reported as injuring strawberries, observations by Gentner made during the year indicate that it is well established in the State.

Two new and important insect pests recently found in Canada, L. S. McLAINE (*Agr. Gaz. Canada, 7 (1920), No. 10, pp. 793, 794*).—The European corn borer (*Pyrausta nubilalis* Hübner) was found in August at Lorraine Station in Welland Co., Ont. Further investigations have shown infestation to extend from Fort Erie on the east to Dunnville on the west along the Lake Erie shore,

and about 20 miles inland. Investigation of an infestation in the vicinity of St. Thomas, Ont., reported on August 23, showed 5 per cent of the plants in the fields to be infested. Intensive scouting up to September 5 indicate that the St. Thomas outbreak is more intensive and widespread than is the infestation farther east. The heaviest infestation thus far was found in the townships of Yarmouth and Southwold in Elgin Co., where 79.8 per cent of the stalks were infested by one or more borers.

The satin moth (*Stilpnotia salicis* L.), a pest found in Europe and Asia, which often severely attacks poplars and willows, was discovered in the vicinity of Vancouver and New Westminster, B. C., in the latter part of July. If investigations show that infestation is not too widespread, an attempt will be made to eradicate it. It is pointed out that the first record of the satin moth in America was made last spring, when it was discovered in the vicinity of Boston (see p. 252).

The occurrence of injurious forest insects in Sweden in 1917, I. Trägårdh (*Meddel. Stat. Skogsförsöksanst, No. 16 (1919), pp. 67–114, figs. 14*).—The insects mentioned as of particular importance in forests in Sweden during the year 1917 include *Scolytus ratzeburgi* Jans., *Ips acuminatus* Gyll., *Myclophilus piniperda* L., *M. minor* Hart., *I. typographus* L., *Bupalus piniarius* L., and *Cephaleia signata* F.

Three microlepidopterous enemies of rice frequent in riceries in Cochin China, F. Vincens (*Bul. Agr. Inst. Sci. Saigon [Cochin China], 2 (1920), No. 4, pp. 97–105, pls. 2*).—Among the numerous insects which attack the rice plant in riceries in Cochin China are three which are particularly widespread. All three belong to the family Pyralidæ, many of which fold the leaves and perforate the stems. They are *Schœnobius incertellus* Wlk., *Chilo suppressalis* Wlk., and *Cnaphalocrocis medinalis* Guénée. The larvæ of the first two chiefly attack the stems, in the interior of which they live, and it is difficult to distinguish between them by the injury which they cause. The injury by *C. medinalis*, however, is exclusively to the leaves. After the harvest *S. incertellus* remains in the stubble, while *Chilo suppressalis* continues to live and reproduce in the weeds which follow. A detailed account of *S. incertellus* in Formosa, by Shiraki, has been noted (E. S. R., 42, p. 55), as has a reference to its occurrence in the Portuguese East Indies (E. S. R., 42, p. 451).

Conference on spraying schedules, W. W. Yothers, J. R. Winston, et al. (*Fla. State Hort. Soc. Proc., 32 (1919), pp. 145–151*).—A spray schedule for citrus is incorporated in this account.

Fumigation of citrus plants with hydrocyanic acid: Conditions influencing injury, R. S. Woglum (*U. S. Dept. Agr. Bul. 907 (1920), pp. 43, pls. 4, fig. 1*).—This paper presents the results of experiments conducted with a view to determining the prefumigation and postfumigation influence of heat and light upon the hydrocyanic acid gas treatment. The results of the investigations have been summarized as follows:

"Sunshine is the chief prefumigation factor that increases injury, and this influence is greater at high temperatures than at low. Under darkness or diffused light, temperatures upward to at least 100° F. do not appear to increase injury unless the fumigation or postfumigation temperatures exceed 80°. The environment after fumigation approximates in importance that during the actual treatment. Of the postfumigation factors, both sunshine and temperature modify the degree of injury. Sunshine, the more important, is most destructive to plants exposed immediately after fumigation, but affects them deleteriously at least two hours after the treatment. Temperatures of 80° or above injure plants more severely than lower temperatures.

"The fumigation of citrus plants is most safely performed at temperatures below 80°. Diffused light before, during, or after fumigation exerts no more deleterious influence than darkness. Moisture on citrus plants does not increase the degree of injury. An application of cool water to plants in hot sunshine immediately prior to fumigation appears to reduce slightly the effect of the gas.

"Sudden changes of temperature over a wide range during exposure to hydrocyanic-acid gas tend greatly to increase plant injury. The optimum environment for safety to plants is diffused light or darkness at uniform temperatures below 80° before, during, and after the fumigation. The lowest temperature tried, 55°, was within the range of the optimum. Fumigation at temperatures upward of 80° is safest under cool prefumigation and postfumigation environments. The maximum of injury follows high temperatures for all three environments.

"The physical and chemical conditions of the soil influence injury from fumigation. Trees in a wet soil tend to be more severely injured than healthy trees in a dry soil. However, trees in soils deficient in moisture for such protracted periods as to be severely weakened are more susceptible to injury than if grown under optimum moisture conditions. Irrigation should follow fumigation, not precede it.

"The physiological condition of plants is one of the most important factors regulating fumigation damage. A condition akin to hardiness appears to be the optimum for gas resistance and is brought about by dryness of the soil, cold weather, and possibly by continued very hot dry weather which exceeds the optimum for the plant. Sunshine fumigation can be conducted with safety by proper regulation of the dosage and length of exposure."

A list is given of 23 references to the literature.

Insect control in flour mills, E. A. Back (*U. S. Dept. Agr. Bul. 872 (1920), pp. 40, figs. 15*).—This is a practical summary of information upon the subject.

"Experimental and practical demonstration work has proved the dependability of methods of control under certain conditions. These are fumigation with hydrocyanic-acid gas and the use of heat. Control by freezing is less satisfactory. Smudges, as compared with fumigation with hydrocyanic-acid gas or the application of high temperatures, have only a temporary value. Preventive measures, including cleanliness, are of the greatest value in reducing losses due to insects. Dependence upon natural control by parasites is not advocated. The heat method is recognized as the most effective, practical, and inexpensive of all treatments and has the added advantage of being absolutely safe. Where remedial measures must be applied in mills of moderate size, it has been estimated that the heat method is enough cheaper to pay in five years for the cost of the installation of enough radiation surface properly to heat the mill. Neither fumigation with hydrocyanic-acid gas nor the use of high temperatures, as recommended for mill-insect sanitation, injures the mill building or equipment or affects the baking qualities of flour."

The occurrence of the chinch-bug in eastern Massachusetts, G. W. Barber (*Jour. Econ. Ent., 13 (1920), No. 4, pp. 369, 370*).—Notes on the discovery of this pest in August, 1919, at Beverly, Mass.

Four papers on homopterous insects, J. G. Sanders and D. M. De Long (*Penn. Dept. Agr. Bul. 346 (1920), pp. 22, pls. 5, fig. 1*).—The technical papers here presented are: (1) Descriptions and Figures of Eleven Confused Species of Deltocephalus Infesting Grasses (pp. 3–14), (2) Five New Species of Cicadellidæ (pp. 15–18), (3) New American Records and Notes of Cicadellidæ (pp. 19, 20), and (4) Six Species of Deltocephalus, with Notes and Photomicrographs (pp. 21, 22).

A scale enemy of the orange, lemon, and tangerine in Uruguay, G. B. Schurmann (*Rev. Min. Indus. Uruguay, 8 (1920), No. 52, pp. 153–164, figs. 8*).—This brief account relates particularly to the purple scale and means for its control in Uruguay.

Gipsy moth spraying work, F. W. Rane (*Mass. State Forester Ann. Rpt., 16 (1919), pp. 21–23, pl. 1*).—Use is being made of a very practical and convenient sprayer, referred to as the "four-horse" sprayer, which can be carried on a Ford truck or one-horse wagon, and has good power. It covers trees of ordinary height, and the ease with which it is transported makes it a valuable auxiliary to a larger sprayer. The fact that at least three of these small sprayers can be obtained for the price of a large one, and can be manned by a much smaller crew, are points which tend to popularize their use. They are also well adapted for spraying orchards and private work in general.

A comparison is made of the dry and paste arsenate of lead, showing that the dry form is more economical, as there is far less waste and the amount used is more uniform.

A European pest found in Massachusetts, A. F. B[urgess] (*Jour. Econ. Ent., 13 (1920), No. 4, p. 370*).—The satin moth (*Stilpnotia salicis* Linn.), first found in Medford, Mass., recently, is known to occur in 27 towns in the State. The larvæ feed on poplar, willow, and other trees. In the worst infested area discovered, poplar trees have been defoliated and others partially stripped.

Notes on the life history, habits, and control of the pea moth (Laspeyresia nigricana Steph.), W. H. Brittain (*Ent. Soc. Nova Scotia Proc., No. 5 (1919), pp. 11–20, pl. 1*).—The pea moth, an account of which, by C. L. Fluke, jr., has been previously noted (E. S. R., 43, p. 257), is said to be the most troublesome insect enemy of the pea in the Maritime Provinces of Canada. Its ravages vary greatly in intensity from year to year, but it is always present and destroys from 10 to 50 per cent of the crop. In some pickings at the agricultural college at Truro, in the summer of 1918, the percentage of infestation was as high as 75 per cent, making it impossible to market the crop unshelled, and when shelled only at a financial loss.

The author finds that the eggs are deposited only on the sepals of partially developed pods. There was no evidence that the pods ripened prematurely, nor do they open naturally, permitting the caterpillar to escape. On the contrary, the caterpillar bores out through the pod before the peas are ripe. An extensive search in the field failed to detect them in any other situation.

In rearing work the author found that instead of 14 days, as has been reported to be required for incubation of the egg, only 2 or 3 days were required. The eggs are laid from 4 to 7 days after emergence. From 17 to 20 days were spent by the larva in the pod, and due to the long period over which the moth emerges larvæ are found in the pods from about the middle of July until about the middle of September. Winter is passed in a silken cocoon in the soil, where the insect remains until July or August of the following season. The first pupa was found in 1919 on June 19, and the first adult appeared on July 12.

In control work with arsenicals, calcium arsenate has given the best results, though none of the treatments have been entirely satisfactory. The results obtained in control experiments are reported in tabular form.

The pea moth a new species, C. Heinrich (*Canad. Ent., 52 (1920), No. 11, pp. 257, 258, figs. 2*).—The pea moth, which has been a source of injury, particulary in Ontario, Quebec, and the Maritime Provinces of Canada, and has previously been recorded as *Laspeyresia nigricana* Stephens, is described by the author as *L. novimundi* n. sp.

Dust and the spray gun in calyx worm control, L. CHILDS (*Jour. Econ. Ent., 13 (1920), No. 4, pp. 331–338*).—This account by the entomologist of the experiment station at Hood River, Oreg., is summarized as follows:

"The percentage of calyx entrants in apples is a very variable factor. In some seasons larger percentages enter than in others. There is much variation in different varieties of apples. The percentage of calyx entrants is not so great in the Northwest as one would be led to believe in reviewing the literature on the subject.

"Dust controls calyx worms. It can in no sense of the word be called a 'driving application.' The material settles upon the locations needing protection and accomplishes results if properly applied; this including calyx protection. Spray applied in finely broken up particles operates in exactly the same way whether applied with a rod or spray gun.

"The spray gun, in order to produce the proper type of spray can not be used on inferior equipment. Two hundred and seventy-five pounds pressure with a 3½-horsepower sprayer produces a fair spray with two guns, an excellent spray with one gun. There is a very great need for higher powered sprayers with a liberal reserve. To be entirely effective the gun must be backed up with such equipment."

Observations on the codling moth in walnuts, H. J. QUAYLE (*Better Fruit, 15 (1920), No. 1, pp. 19, 20*).—This is a partial report of investigations conducted by the Citrus Substation at Riverdale, Calif. Though first described in France under the name *Carpocapsa putamina*, this pest of walnuts is now considered to be the same as the species that attacks the apple. From the experiments of the first year, in which larvæ were transferred from the walnut to the apple and from the apple to the walnut, it appears that they can be thus transferred without affecting their development. At the present time the codling moth on walnuts is an economic problem in the vicinity of Santa Ana and Tustin, and Capistrano and Carpinteria. Occasional records of its recurrence in walnuts have also been secured in several other localities.

In 1919 the first eggs were observed on the walnut in Santa Ana on May 8. "The first larvæ appeared during the second week in May and continued to appear until the middle of July. The first brood of moths began to emerge on June 28 and continued until the last of August. The second brood of eggs was first observed July 7 and continued to appear until the first of September. Larvæ of the second brood began to appear about the middle of July, the maximum numbers occurring the last of July and the first of August. A third brood appeared later, and larvæ were observed to enter the nuts up to the first of October." The life history is very different at Carpinteria, since the insect is three or four weeks later in making its appearance.

Many of the larvæ that appear early in the spring enter the nut at the calyx end, but later when protection is afforded by the contact of the nuts most larvæ enter at these points. Nuts attacked while they are still immature fall to the ground and are not accounted for at harvest time. Up to the middle of July, by which time the shell is not hardened to any extent, the larvæ usually bore directly toward the center of the nut, but after that time they only enter through the suture at the base. "They may enter the husk where two nuts are in contact as usual, but when the shell is reached they bore along the shell more or less at random. The majority of them sooner or later find the suture, where they enter and feed on the meat of the nut. Some that do not find the suture may complete their development in the husk of the nut alone."

While band traps aid, the principal means of control consists of spraying or dusting with basic or neutral arsenate of lead. Where spraying is restorted to,

which proved satisfactory during 1919 in control of the pest in the walnut, 25 gal. is required to cover an average sized walnut tree, as many as 35 gal. being required for the largest trees. Dusting during 1919 in the Santa Ana and Carpinteria sections resulted in considerable reduction of wormy nuts. The chief objection to its use during the year was due to the lack of thoroughness in covering the tree.

The aphis is readily killed by the dust, which with the codling moth must be deposited on every nut for good control. In the Santa Ana district the first application should be made during the last week of May and the first week or two of June, and the second application about July 15. At Santa Ana the greatest injury is done by the summer brood during July and August, while at Carpinteria the greatest injury is done by the spring brood during the latter half of July, since there is practically a full brood less there. One application at Carpinteria the latter part of June or first part of July ought to be sufficient. In examinations made of over 100 orchards, 4.73 per cent of the nuts were found wormy in dusted orchards against 6.33 per cent in orchards not dusted in the Santa Ana area, and 4.2 per cent in dusted orchards against 9.7 in orchards not dusted in the Carpinteria area.

Some results with nicotin and nicotin combinations in experiments on the control of Laspeyresia molesta Busck, L. A. Stearns (*Jour. Econ. Ent., 13 (1920), No. 4, pp. 364–367*).—The data here presented have been noted from another source (E. S. R., 43, p. 558).

The pink bollworm (Gelechia gossypiella Saunders) in Egypt in 1916–17, H. A. Ballou (*Cairo: Govt., 1920, pp. VIII+120, pls. 21*).—This reports investigations of control measures for the pink bollworm, conducted in Egypt from September, 1916, to February, 1918, as noted (E. S. R., 42, p. 547).

Part 1 (pp. 5–48) of this report deals with the life history and habits of the pink bollworm, part 2 (pp. 49–70) with the damage caused by it, and part 3 (pp. 71–110) with its control. An annotated bibliography of 41 titles follows. An appendix (pp. 117–120) deals briefly with the cotton crop of Egypt. The account of the pest in Egypt by Willcocks, referred to by the author, has been noted (E. S. R., 40, p. 856).

The life history of the strawberry tortrix (Oxygrapha comariana Zell.), F. R. Petherbridge (*Ann. Appl. Biol., 7 (1920), No. 1, pp. 6–10, pl. 1*).—This is a report of studies of an enemy of the strawberry, which caused serious damage from 1913 to 1917 at Terrington St. Clements, Walpole, and Walton, England, in several cases reducing the crop to about 25 per cent of a normal one, with the result that many acres of strawberries were plowed up as being unprofitable.

The eggs which are deposited the beginning of November hatch the last of April or early in May, and the larvæ are found feeding until nearly the end of June. Pupation occurs in webs on the leaves during June, and moths appear from early in June up to the end of July. The eggs of the next generation are found during July on the backs of the stipules at the base of the plants, and occasionally on the lower part of the leafstalk; and caterpillars occur from the middle of July until September 5. Pupæ are found from the third week in August to the end of the third week in September, and moths from the second week in September to the third week in November.

Larvæ as soon as they hatch in the spring begin to feed on the very young folded fan-shaped leaves and to make holes through the successive layers, sometimes leaving the upper epidermis intact. They remain sheltered by the folded leaves; some of the larvæ soon begin to feed on the unopened flowers.

They bore holes through the folded calyxes and feed on the stamens and developing carpels, with the result that the flowers attacked either do not form fruit or form only distorted ones. The caterpillars bind the leaflets, and often several leaves together, by means of threads, and also make little webs on the backs of the leaflets under which they feed and moult. Pupation takes place on the leaves which have been spun together.

In tests made arsenicals did not succeed in reducing the infestation to any extent.

The house fly as a danger to health: Its life history and how to deal with it, E. E. Austen (*Brit. Mus. (Nat. Hist.), Econ. Ser., No. 1 (1913), pp. 11, pls. 2, figs. 3*).—This is the first of a series of popular accounts relating to ectoparasites of man, of which the second and third, by Cummings and Waterston, respectively, have been previously noted (E. S. R., 37, pp. 762, 764).

The house fly: Its life history and practical measures for its suppression, E. E. Austen (*Brit. Mus. (Nat. Hist.), Econ. Ser., No. 1A (1920), pp. 52, pls. 3, figs. 5*).—This account, though similar in its objects to the pamphlet noted above, is of wider scope. It is based upon the author's experience on three fronts during the course of the world war, which has enabled him to take into consideration the requirements of both the army and civil population in his discussion of control measures.

The tachina fly (Phorocera doryphoræ), an interesting parasite on potato beetles, L. M. Geismer (*Potato Mag., 3 (1920), No. 3, p. 8*).—This article calls attention to the control of the Colorado potato beetle in certain localities in Alger and Houghton Counties, in the upper peninsular of Michigan, by this tachinid parasite. It is stated that in the summer of 1900 in certain localities of Alger County the beetles could scarcely be found, while in the vicinity of the upper peninsular experiment station they were quite numerous, practically every adult, as well as some of the larger larvæ being covered with from one to eight or even more eggs of this parasite. The beetles were scarce in the vicinity of the experiment station during the following season, and neither flies nor their eggs could be found. None have been seen or reported since that year, although careful watch has been kept for them.

During the season of 1920 there were localities in Houghton County where the potato beetle was very scarce, and others in which they were quite abundant, thus resembling the condition in Alger County in 1900. In the vicinity of Dodgeville the potato beetle was very numerous, and practically all the beetles as well as the full grown larvæ were found covered with from one to five or more eggs of the parasite. In all directions from this locality evidence of the parasite disappeared gradually, until in potato fields five miles away eggs were only found on less than one beetle or larva of every hundred.

"The foregoing observations indicate that this beneficient fly is at work in large numbers in restricted areas only, but within an extensive territory and in several States. They also indicate that the fly either migrates from year to year to other localities, or else has other hosts upon which it prefers to rear its young from time to time. That the flies can not increase to any great extent is due to the poisoning of the potato beetles, a practice which has become quite general, for the poisoned beetles dry up rapidly and this leaves the young maggots which may hatch out of the fly's eggs without a living host and consequently without food."

An account of tropical fruit flies, G. Enderlein (*Zool. Jahrb., Abt. System., Geogr. u. Biol. Tiere, 43 (1920), No. 1–4, pp. 336–360*).—This account of tropical fruit flies includes descriptions of 29 species new to science. Six genera are erected.

A handbook of British mosquitoes, W. D. LANG (*London: Printed by Order of Trustees British Mus., 1920, pp. VII+125, pls. 5, figs. 135*).—A brief introductory account of mosquitoes, their life history and structure, is followed by a discussion of their identification in the adult and larval stages (pp. 20–73). A systematic account is next given of the 20 species, representing 9 genera, which have been found to occur in the British Isles (pp. 73–111). Reputed, doubtful, and fossil British species are mentioned (pp. 111–113), and evolutionary and concluding remarks follow (pp. 113–117).

The control of breeding of yellow fever mosquitoes in ant-guards, flower vases, and similar containers, J. ZETEK (*Jour. Econ. Ent., 13 (1920), No. 4, pp. 344–350*).—"About 2 gm. or more of para-dichlorobenzene, repeated every seven days during the rainy season or even ten days during the dry season, was found to prevent the breeding of yellow fever mosquitoes in ant-guards. It is necessary that the para-dichlorobenzene be used in powdered form and be well scattered in the guards. About 2 gm. of powdered para-dichlorobenzene, or the same amount of camphor (either lump or powdered), was found very effective in preventing the breeding of yellow fever mosquitoes in flower vases and similar receptacles. It should be repeated every 15 days, or each time the water is changed. For holy-water urns, especially in churches, lump camphor is recommended. The use of these insecticides should be considered obligatory, and if, after due notice has been given, breeding is found, especially pupæ, then the offender should be dealt with severely and to the full extent of the law, particularly so if yellow fever exists in the community. The central station of the sanitary corps should have these insecticides on hand and sell them to the public at, or nearly at, cost."

Mosquito control in a southern army camp, S. M. DOHANIAN (*Jour. Econ. Ent., 13 (1920), No. 4, pp. 350–354, pls. 3*).

New species and varieties of Phyllophaga, J. J. DAVIS (*Ill. Dept. Registr. and Ed., Div. Nat. Hist. Survey Bul., 13 (1920), Art. 12, pp. 327–338, pls. 6, figs. 8*).—The author has recognized several new species and varieties of May-beetles among collections received from different sections of the country, namely, *P. perlonga*, from Mississippi, Arkansas, and Tennessee; *P. fraterna mississippiensis*, from Mississippi; *P. pearliae*, from Tennessee, Kentucky, and Indiana; *P. soror* and *P. impar*, both from North and South Carolina; *P. foxii*, from Virginia and South Carolina; *P. parvidens hysteropyga*, from Texas and Florida; and *P. hirticula comosa*, apparently from Kansas.

Western twig pruners, F. B. HERBERT (*Jour. Econ. Ent., 13 (1920), No. 4, pp. 360–363*).—One of the species noted is *Polycaon confertus* Leconte, often called the olive twig borer, which prunes the twigs of almond, apple, apricot, avocado, birch, cherry, currant, English elm, *Eugenia myrtifolia*, fig, grape, live oak, olive, orange, peach, pear, prune, and the strawberry tree (*Arbutus unedo*). It usually bores in at the forks of two small branches, entering for a quarter inch or more and throwing out considerable frass behind it. The beetle does not breed in many of these trees, however.

P. stoutii Leconte is reported to prune twigs in the same manner. *Apate punctipennis* (Leconte), called the western twig borer, burrows into the twigs of different orchard trees, particularly apricot, much in the same way as does *P. confertus*. *Phlœosinus cupressi* Hopkins and *P. cristatus* Leconte are bark beetles of the family Ipidæ, which have the abnormal habit of pruning small twigs. Both breed in a number of cypress and cypress-like trees. Mention is also made of *Leperisinus* sp. (near *aculeatus* Say) and *Agrilus angelicus* Horn.

The beet leaf-beetle [Monoxia puncticollis Say.], F. H. CHITTENDEN and H. O. MARSH (*U. S. Dept. Agr. Bul. 892 (1920), pp. 24, pls. 9, figs. 4*).—"In the

Rocky Mountain States sugar beets and garden or table beets, Swiss chard, and spinach are subject to attack by the beet leaf beetle (*M. puncticollis*), or 'alkali bug,' an insect resembling the elm leaf beetle. This insect normally lives in alkali regions, breeding on such weeds as the sea-blites, Russian thistle, saltbush, and lamb's quarters, but when it becomes abundant there is an overflow to cultivated plants, which are attacked and often greatly injured. Injury is accomplished chiefly by the larvæ, although the beetles also do much damage, not infrequently eating young beets 'down to the ground.' Many hundreds of acres of beets are destroyed every year. The beetles also act as carriers of a fungus disease.

"The beetles issue from their winter quarters during March and April, feed on weeds, mate, and within a short time begin laying their eggs. The rounded oval, orange-yellow eggs are laid on the underside of the leaves in masses of varying number, from 2 or 3 to 50, a single female depositing between 300 and 400 eggs and even more. These hatch in from 8 to 18 days, depending upon the temperature, and the larvæ complete their growth in from 14 to 29 days. The larvæ feed in exposed positions on either the upper or lower surface of the leaves, eating holes in them, frequently cutting entirely through the leaf. When mature, the larvæ leave the plants and burrow into the earth to a depth of from 0.5 in. to 2 in. and form cells in which the soft yellow pupæ develop. The pupal period requires 8 or 9 days, and then the beetles emerge. Two generations and a partial third generation are produced annually in the Arkansas Valley of Colorado, where the species has been studied.

"Hibernation is passed as a beetle in alkali areas under tufts of grass, heaps of dead weeds, and other rubbish, and the grower may take advantage of the knowledge of this habit to destroy the beetles in their winter quarters, which has proved an effective and practicable method of control. The best time for this work is between the middle of November and the first of March, when the dead grass and weeds may be burned. The effectiveness of this method depends on the thoroughness with which the hibernating quarters of the beetles are destroyed. The use of arsenicals has not been entirely satisfactory in the control of this pest."

The western cabbage flea-beetle [Phyllotreta pusilla Horn], F. H. Chittenden and H. O. Marsh (*U. S. Dept. Agr. Bul. 902 (1920), pp. 21, pl. 1, figs. 4*).—This account is based upon observations of *P. pusilla* at Rocky Ford, Colo., from 1909 to 1917. In the Western States cabbage, turnips, and other cole crops, beans, peas, table and sugar beets, mustard, kale, rape, and other vegetable and garden plants are severely injured by this flea-beetle.

"Injury is chiefly due to the overwintered beetles during June and July, but the beetles accomplish more or less injury during the growing season. This flea-beetle develops on the roots of wild and cultivated cruciferous plants. The beetles frequently appear in great numbers, eat minute pitlike holes in the leaves of young plants, and often cause considerable injury in seed beds. The entire life cycle from egg to adult may be passed in about 30 days in June and July, and there are at least three generations produced annually.

"Crops may be protected by means of a spray of arsenate of lead, applied at the rate of 2 lbs. powder to 50 gal. of water, or by Bordeaux mixture, 4:4:50 formula, these sprays acting as repellents. It can also be controlled by nicotin sulphate, 0.5 pint 40 per cent solution in 50 gal. of water with 2 lbs. of soap added, and by tobacco dust, which are deterrents. It is not possible, however, to control this insect entirely when it occurs in its greatest abundance. In addition, it is desirable to keep the plants thrifty and well watered; mechanical traps and trap crops can be used with advantage; and clean culture is always advisable, especially the destruction of weeds in and near cultivated fields."

The banana borer in Fiji (*Reprinted in Agr. News [Barbados], 19 (1920), No. 474, p. 202*).—This is a brief account of the present status of *Cosmopolites sordidus* in Fiji.

Bee investigations (*Kansas Sta. Rpt. 1919, pp. 67, 68*).—In studies on wintering bees two sets of three hives each, including one single-story hive unpacked, one two-story hive unpacked, and one packed hive in each set, were placed on scales, one set being placed in a protected place and one in the open. It was found that the amount of honey consumed by the bees in the sheltered place varied but little from the amount consumed in the unsheltered hive, but that the sheltered hives wintered a larger number of bees than the unsheltered.

Wintering bees in Canada, F. W. L. SLADEN (*Canada Expt. Farms Bul. 43, 2, ser. (1920), pp. 12, fig. 1*).—This is a general summary of information upon the wintering of bees.

A tenthredinid (Cimbex quadrimaculata Müll.) injurious to the almond tree, R. SARRA (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Super. Agr. Portici, 12 (1917–18), pp. 275–286, figs. 4; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 10 (1919), No. 5, p. 634*).—A description and biological notes are given on this pest, which was observed, principally on almond trees, in the Provinces of Bari and Potenza, Italy. The most serious damage was done to seedlings in the nursery and young grafted trees. The larvæ are parasitized by *Ophcltes glaucopterus* L. and *Lampronota melancholica* Grav. to the extent of 20 and 25 per cent, respectively.

FOODS—HUMAN NUTRITION.

Margarin, W. CLAYTON (*London and New York: Longmans, Green & Co., 1920, pp. XI+187, pls. 10, figs. 12*).—This volume, which is one of the series of Monographs on Industrial Chemistry edited by E. Thorpe, includes a brief historical account of the development of the margarin industry; a description of the modern processes of the manufacture of margarins; a discussion of the chemistry of the constituents, and methods of their analysis and that of the finished products; chapters on butter, renovated butter, and compound lard; and a final chapter on nutritional chemistry, in which is discussed the question of the nutritive value of margarins from the standpoint of their digestibility and their content of fat-soluble vitamin.

"In conclusion, it is well to recall that butter, owing to the 'influence of feed, storage conditions, and temperatures used in the renovation of inferior products, and even the method of use of the product in the home,' may not exceed a good oleomargarin in nutritive qualities. The whole question seems to depend upon the adequately varied and balanced diet of the individual. Children should preferably be fed on butter, but adults, with their stronger digestive powers, may with absolute impunity replace butter by either oleo or vegetable margarin, provided they consume sufficient amounts of the vegetative green parts of plants, since these furnish an ample supply of all three vitamins."

A brief discussion of the denaturing of margarin and an extensive bibliography are appended.

Milk and meat in the food supply (*Pub. Health Rpts. [U. S.], 35 (1920), No. 17, pp. 994–996*).—A summary and discussion of work recently published, ending with the general conclusion that "a moderate shifting of emphasis from meat to milk will help in the normal evolution" in the diet.

The influence of various carbohydrates on the coagulation of milk, E. ASCHENHEIM and G. STERN (*Biochem. Ztschr., 102 (1920), pp. 98–123*).—The results are reported of an ultramicroscopic study of the effect of carbohydrates

on the coagulation of milk in mixtures used for infant feeding, such as mixtures with oatmeal, oat gruel, sucrose, lactose, etc.

The method consisted of preparing the usual milk mixtures at different dilutions with and without the addition of sugar, and sterilizing in a milk sterilizer for 5 minutes. To 10 cc. of such a mixture was added 0.05 cc. of rennet and 0.05 cc. of N/10 HCl. After thorough shaking the mixture was placed in an incubator and the progress of coagulation observed by the use of an ultramicroscope. When coagulation was complete the material was centrifuged for 10 minutes and the separated coagulum spread out on a dark glass plate and examined for its consistency. The results obtained from the various mixtures are summarized as follows:

Pure milk and water mixtures showed a much more consistent coagulum than the milk-oatmeal and milk-gruel mixtures. Of the latter the milk-oat gruel mixture gave the most flocculent coagulum, closely resembling that of human milk. On the addition of sugar these differences were lessened in proportion to the strength of the sugar. Cane sugar and Soxhlet nutritive sugar appeared to have less influence than the milk sugar.

The metabolism of carbohydrates.—I, Stereochemical changes undergone by equilibrated solutions of reducing sugars in the alimentary canal and in the peritoneal cavity, J. A. Hewitt and J. Pryde (*Biochem. Jour., 14 (1920), No. 3–4, pp. 395–405, figs. 5*).—This paper describes a number of abnormal and unexpected results obtained in an experimental study of the rate of absorption of simple carbohydrates by living tissues (the intestines and peritoneum of rabbits).

Solutions of *d*-glucose in equilibrium, when introduced into the intestines of the living animal, were found to undergo a rapid downward mutarotation to optical values corresponding with specific rotations much below +52.5. After withdrawal from the intestine, these solutions underwent slower upward mutarotation to a permanent value corresponding with the specific rotation of α- and β-glucose in equilibrium. The authors are of the opinion that these stereochemical changes can not be attributed to the preferential absorption of the α form or to the formation of sugar complexes such as disaccharids, but are the result of the transient formation of γ-glucose.

No evidence was obtained of similar stereochemical changes occurring in sugar solutions which had been introduced into the peritoneal cavity.

Infant feeding, C. Francioni (*Bol. Soc. Ital. Studio Aliment., 1 (1919), No. 1–3, pp. 1–16*).—This is a discussion of the relative merits of "natural, mixed, and artificial alimentation," these terms being used to signify feeding with mother's milk, cow's milk, and a mixture of the two. While conceding that mother's milk should be used where possible, the discussion centers around the use of mixed milk. The opinions of various authors concerning the best proportions of mother's and cow's milk are cited, and attention is called to the various points of superiority of mother's milk.

The problem of the hospital dietitian, A. F. Morgan and A. H. Metcalf (*Calif. State Jour. Med., 18 (1920), No. 7, pp. 255–257*).—In connection with a summary of information collected in studies of the dietetics departments of some representative hospitals, the authors discuss the kind of training a dietitian should have, the duties of the position, and similar topics.

Personal considerations regarding the army ration, A. Lustig (*Bol. Soc. Ital. Studio Aliment., 1 (1919), No. 4–6, pp. 83–90*).—This is a criticism of the Italian Army ration of 1920, which consisted of bread 700 gm.; fresh or frozen beef 200; substitutes for meat, including dried fish, canned meats, etc., 150; canned salmon 235; Italian paste 180, or rice 150; dried legumes 50, or potatoes

100; roasted coffee 10; sugar 15; and lard or oil 15 gm. In addition, certain condiments are included and cheese in amounts of 10 gm. three times a week.

The ration is criticized on the ground that the alternatives are not of equal value, and that the ration is too low in calories and fat and does not furnish sufficient vitamins.

The influence of rationing in Denmark on health, M. HINDHEDE (*Deut. Med. Wchnschr., 45 (1919), No. 45, pp. 1236, 1237*).—The author briefly discusses this on the basis of his experiments and reaffirms his belief in the great value of a diet of whole wheat bread, greens, and potatoes.

Standards of living, a compilation of budgetary studies (*Bur. Appl. Econ., Inc., [Wash., D. C.], Bul. 7 (1920), pp. V+156*).—This publication reprints the more significant sections of 19 studies of the cost of living made by various official and private organizations during the years 1914–1919. In each case the item of food is considered in considerable detail.

The woman's committee, U. S. Council of National Defense.—An interpretative report, April 21, 1917, to February 27, 1919, E. N. BLAIR (*Washington: Govt., 1920, pp. 150*).—This summary of the organization and activities of the Woman's Committee of the Council of National Defense and its affiliated committees and organizations in the various States includes statistics and general descriptions of the work done in connection with food conservation, home vegetable gardens, and a study made of agencies for the sale of cooked foods without profit.

Standard railway sanitary code (*Pub. Health Rpts. [U. S.], 35 (1920), No. 30, pp. 1749–1761*).—This code, approved by the conference of State and provincial officers of health and recommended to the several States for adoption, contains sections dealing with the preparation and serving of food on trains, in station restaurants, and in construction camps, and with the water and ice used for drinking and culinary purposes. The need of inspection of the physical condition of those handling the food, screening of the windows and doors, care of the tableware, disposal of garbage, and other points that have to do with the sanitary condition of food, is clearly set forth.

Studies in the vitamin content, W. H. EDDY and H. C. STEVENSON (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 295–309, fig. 1*).—An investigation of the Bachmann (E. S. R., 42, p. 59) and Williams (E. S. R., 41, p. 670) methods of determining water-soluble B has led to a modification of the latter method as follows:

The materials used in the test are capillary pipettes, a dilute suspension of yeast cells (Fleischmann) in Nägelis solution, and a sterile solution of the vitamin extract to be tested. A suspension of the yeast cells from an agar slant is made by shaking as small a portion as can be taken up on the point of a needle in 10 cc. of the Nägelis solution for 2 or 3 hours in a mechanical shaker. One unit of the yeast suspension and one unit of the vitamin extract are drawn up into the sterilized pipette and mixed, the ends of the pipette sealed, and the tubes incubated for 20 hours at 35° C. The tips of each pipette are then broken, a bulb is placed on the large end, and the contents blown out on a slide, fixed and stained. For control, another series of pipettes is prepared and filled by drawing up a unit of yeast suspension without the unit of vitamin. These are incubated and counted in the same way as the test pipettes. By using a number of tubes for each test greater accuracy can be secured.

The results are reported of various applications of the method. Trial tests have indicated that the test is sensitive to small amounts of vitamin extract. The specificity of the test is shown by the results obtained with small quan-

tities of the Funk antineuritic vitamin. Tests with navy bean extract and with sterile orange juice, before and after extraction with Lloyd's reagent, indicate the selective adsorption of the active constituent by the reagent and further prove the specificity of the test for B-vitamin. That the stimulus removed in the case of the orange juice was the B-vitamin and not the C was further proved by positive results obtained in prophylactic and curative experiments with guinea pigs, using as the active reagent the filtrate from the Lloyd reagent extract which had failed to cause increase in yeast cells.

Other tests reported indicate that at 120° a partial destruction of the vitamin takes place, and that alkalis also have a destructive effect. Estimations of the content of this vitamin in the jugular and mammary vein plasma of a pregnant cow showed the mammary vein to contain appreciable amounts.

Comparative estimations of the B-vitamin content of different foodstuffs were made by the following method: "First, establish by counting of units the probable range of variation in the suspension used. Second, make from 5 to 10 tests on each substance tested, and in these test results eliminate all zero readings as showing that the unit in that case contained no cells. Average all other readings. Repeat as often as seems necessary to clear up doubtful positions."

The results are given of this procedure as applied to extracts of different materials prepared by drying the material at 60°, extracting equivalent amounts for the same length of time in boiling water, making up to the same volume, and sterilizing in the Arnold sterilizer. The results of five determinations on each extract are reported. The substances tested in decreasing order of potency were alfalfa, potato, celery, apple, tomato, cucumber, turnip, radish, onion, and carrot. While these results are not considered conclusive, it is pointed out that in certain cases they harmonize with the feeding results recently obtained by Osborne and Mendel (E. S. R., 42, p. 759.)

The extraction of the fat-soluble factor of cabbage and carrot by solvents, S. S. Zilva (*Biochem. Jour., 14 (1920), No. 3-4, pp. 494-501, figs. 7*).—This paper describes the successful extraction of fat-soluble A from fresh vegetables by absolute alcohol and subsequently by ether. Cabbage was first used, but as the extract was not relished by the rats serving as experimental animals, carrots were substituted for the cabbage. The experiments with the cabbage extract, however, demonstrated the possibility of extracting fat-soluble A by the method employed, which consisted essentially in grinding the material with sand and allowing it to stand in a cool dark place for about 12 to 18 hours with 5 parts of absolute alcohol for 1 of the material. The alcohol extract was then evaporated in vacuo at 35° C.

The extract of carrots, in amounts equivalent to 25 gm. of the fresh material, when added to a diet adequate except for fat-soluble A caused renewal of growth in young rats. Growth was also induced by the administration of doses of the extract equivalent to 15. 5, and 1 gm. of the fresh carrots, the extract from 15 gm. producing almost normal growth and that from 5 and 1 gm. slight growth. The extract dried in vacuo at a low temperature and kept in a desiccator was found to retain its active properties to the extent that after a fortnight an equivalent of 25 gm. of the fresh material was sufficient to induce good growth and cure xeropthalmia.

Tests for the presence of the antineuritic and antiscorbutic factors, conducted with rats and guinea pigs, respectively, indicated that equivalents of 25 gm. per day were about the minimum for growth of rats on a diet lacking in water-soluble B. The same amount was also sufficient to delay the onset of scurvy, but not to prevent a fatal termination of the disease in a guinea pig on a diet deficient in the antiscorbutic vitamin.

An ethereal extract from the alcoholic fraction in amounts equivalent to 25 gm. of the fresh material was able to promote recovery and renew growth in rats declining in weight on a diet deficient in fat-soluble A. This is considered to indicate the solubility of fat-soluble A in ether.

Dietetic deficiency and endocrine activity, with special reference to deficiency edemas, R. McCarrison (*Brit. Med. Jour., No. 3111 (1920), pp. 236–239*).—The author summarizes observations concerning the effect of deficient dietaries on the endocrine glands from investigations which have been reported in detail from another source (E. S. R., 43, p. 664). Attention is called particularly to the observation that edema is invariably associated with massive enlargement of the adrenal glands accompanied by an increase in adrenalin in pigeons fed on autoclaved rice, but that enlargement of the adrenals without an increase in adrenalin content is not in general accompanied by edema.

It is also noted that butter made from the milk of cows on green feed afforded greater protection against edema in pigeons fed on autoclaved rice than did the same amount of butter made from milk from cows on dry feed. "The capacity of butter to afford protection against edema, therefore, varies with the quality of the cow's food. A hypothetical 'anti-edema' substance appears to be derived from green fodder. It is unlikely that the two butters differed materially in their protein or fat content. They differed, however, in their lipochrome content, that made from the milk of cows fed on green fodder being richer in this substance. It is suggested that the hypothetical 'anti-edema' substance may be of the nature of lipochromes."

Deficiency disease: With special reference to gastro-intestinal disorders, R. McCarrison (*Brit. Med. Jour., No. 3106 (1920), pp. 822–826, pl. 1*).—In this paper an excellent summary is given of the present status of knowledge concerning vitamins, with special reference to the effects of partial vitaminic deficiency upon the various life processes as influenced by a number of factors combining with the actual deficiency itself.

Etiology of pellagra (*Lancet [London], 1920, I, No. 22, pp. 1166–1168*).—This is the report of a paper on the etiology of pellagra from the standpoint of a deficiency disease, given by E. J. Wood at a meeting of the Society of Tropical Medicine and Hygiene, and of the discussion following the paper.

Notes on the etiology of an outbreak of scurvy in North Russia, with an experiment in test dieting, A. G. Stevenson (*Jour. Roy. Army Med. Corps, 35 (1920), No. 3, pp. 218–223, figs. 2*).—The author describes an outbreak of scurvy among the inmates of the Russian civil prisons in Archangel in February and March, 1919.

The food rations in these prisons were not only extremely low in the antiscorbutic vitamin, but were rendered still more inadequate by the practice of cooking the entire ration just below boiling point for about three hours. To determine the value in treatment of various known vitamin-containing foodstuffs six groups of cases were selected, each consisting of eight cases of a severe type of scurvy. These were given a basal vitamin-free diet similar to the one upon which the disease was contracted, and to this was added or substituted for an equivalent amount of the known vitamin-containing substances one of the following substances: Fresh lemon juice, 4 oz.; germinated peas or beans, 8 oz.; fresh meat, 10 oz.; tinned fruit, 8 oz.; and lactic acid milk, 2 pints. After six weeks on these dietaries all cases showed improvement, this being most marked in the lemon juice, lactic acid milk, and germinated peas groups. Attention is called especially to the favorable results obtained with lactic acid milk as compared with ordinary milk.

A contribution to the study of keratomalacia among rats, M. Stephenson and A. B. Clark (*Biochem. Jour., 14 (1920), No. 3–4, pp. 502–521, pls. 2, figs.*

8).—This contribution consists of a statistical study of keratomalacia (xerophthalmia) in rats in relation to the lack of fat-soluble A, together with histological and bacteriological studies of the affected eyes.

The statistical study is based upon observations in a series of 8 experiments on 46 rats fed a diet consisting of purified caseinogen, starch, sugar, vegetable fat (usually palm kernel oil), and McCollum's salt mixture plus traces of sodium fluorid, potassium iodid, and manganese sulphate, water-soluble B in the form of a fat-free alcoholic extract of yeast, and the antiscorbutic vitamin in 0.5 cc. of lemon juice per rat per day. Of the 46 rats on this diet, deficient in fat-soluble A, 96 per cent failed to survive 90 days and 28 per cent contracted eye disease, the disease in all cases occurring later than the cessation of growth. Of 10 rats which had contracted the disease and were given fat-soluble A in the form of a petroleum ether extract of dried carrot, 100 per cent were cured of the disease, but only 60 per cent restored to health, 40 per cent dying after the eye symptoms had cleared up.

Histological studies were made on the eyes of normal rats on mixed diet, of those which on a diet deficient in fat-soluble A showed no symptoms of the eye disease, of those in which the disease was evident in varying degrees, and of those in which a change of diet had cleared up the disease, either with or without restoration of sight. No histological changes in the cornea preceding the bacterial invasion could be demonstrated, thus making it impossible to determine the precise moment at which the predisposition to infection begins. "The only criterion we possess for determining the preliminary change caused by the deficient diet is the appearance of the secondary symptoms caused by bacterial invasion."

The bacteriological results indicate that the normal conjunctiva of the rat has a varying flora, and that when the resistance of the cornea is affected by prolonged deficiency diet those pathogenic bacteria which happen to be present in the conjunctival sac invade the corneal epithelium and cause destruction of the tissue.

The authors conclude that before the evidence presented serves to place preliminary deterioration of the cornea among deficiency diseases, one of the three following hypotheses must be accepted:

"(1) The symptoms caused by experimental fat-soluble deficiency disease among rats vary in such a way that in some cases the cessation of growth-death symptoms predominate to such a degree that death ensues before the deterioration of the cornea commences, whereas in other cases the nutritive integrity of the cornea is disturbed before the cessation of growth symptoms reach an acute stage. (2) The concentration of the fat-soluble factor in the tissues of the rat necessary to protect the cornea was less than that required for life and growth in 72 per cent of the cases examined (i. e., in those dying without eye disease), whilst the reverse was true in 28 per cent of the cases (i. e., in those developing disease before death). (3) Two factors are involved, one responsible for the continuance of growth and the maintenance of life, and another for the protection of the cornea."

Diabetes in relation to the ductless glands, W. L. Brown (*Brit. Med. Jour., No. 3110 (1920), pp. 191–194, fig. 1*).—In this lecture, delivered before the British Medical Association, diabetes is defined as "a sign of exaggerated metabolism, evoked through the sympathetic and the associated endocrine glands, which first asserts itself in relation to the most abundant food material, but as it advances expresses itself in relation to all." The modern treatment of the disease by fasting or "alimentary rest" is discussed as supporting this view.

An outbreak of food poisoning (*Brit. Med. Jour., No. 3112 (1920), pp. 286, 287*).—A brief note is given of an outbreak of food poisoning in Brixton (England), involving 10 cases and 1 death. The outbreak was traced to a steak and liver stew from which *Bacillus aertrycke* was isolated.

Botulism.—A report of fifteen cases, in three series, G. M. RANDALL (*Med. Rec.* [*N. Y.*], *98* (*1920*), *No. 19, pp. 763–765*).—Brief case reports are given of 15 fatal cases of botulism occurring in three outbreaks.

Four cases occurring in Lowell, Mass., in 1912 were definitely traced to sausages made from pork scraps purchased at a nearby slaughterhouse. Seven cases in Tampa, Fla., in 1916 among sponge fishermen were traced to native ham. The last series reported occurred at a summer resort in Maine in 1920, and while the source of the poison in the four cases reported in this outbreak is not known with certainty, all had eaten ham which was purchased in the open market in a nearby town.

The influence of the spleen upon respiratory metabolism, N. DANOFF (*Der Einfluss der Milz auf dem Respiratorischen Stoffwechsel. Inaug. Diss., Univ. Bern, 1918, pp. 23+[13], figs. 5*).—From experimental data the author concludes that removal of the spleen increases the carbon dioxid output and the oxygen consumption, since the respiratory quotient remained the same before and after the operation. It is evident that the change in metabolism is not qualitative but quantitative; further, that the spleen lessens and its removal favors respiratory metabolism.

A clinical apparatus for measuring basal metabolism, F. G. BENEDICT and W. E. COLLINS (*Boston Med. and Surg. Jour., 183 (1920), No. 16, pp. 449–458, figs. 2*).—The portable respiration apparatus previously noted (E. S. R., 40, p. 465) has been modified, reduced in weight, and provided with support and stand to make it strictly portable. The modified apparatus is described and illustrated, and three series of comparison tests on two different subjects with widely varying basal oxygen requirements are reported. The results of these tests indicate that the accuracy of oxygen consumption determinations by the use of the modified apparatus is fully equal to that of other standard methods of studying respiratory exchange.

ANIMAL PRODUCTION.

Studies in the dynamics of histogenesis, I, II, E. J. CAREY (*Jour. Gen. Physiol., 2 (1920), No. 4, pp. 357–372, figs. 15; 3 (1920), No. 1, pp. 61–83, figs. 25*).—In these two papers the author reports observations on the process of histological differentiation in the alimentary tract as shown by a graded series of pig embryos, and attempts to estimate the mechanical effects of the different rates of growth manifested by different groups of cells. The number of mitoses per square millimeter of cross section is used as the measure of growth activity.

I. *Tension of differential growth as a stimulus to myogenesis.*—The transformation of the mesenchyme cells of the colon into smooth muscle cells was found to be due not to self-differentiation, but to the pressure of the rapidly dividing epithelial cells lining the lumen. Mitosis in the latter follows an upward (cephalad) spiral path, usually a left-handed spiral.

II. *Tension of differential growth as a stimulus to myogenesis in the esophagus.*—A similar explanation is offered for the differentiation of muscle cells in the foregut. The path of growth is here also a left-handed spiral. It is suggested that the normal asymmetry of the abdominal viscera is depended upon this left-handed path, and that one factor in producing situs inversus viscerum is a right-handed spiral growth in the intestine. In the

tracheal bud, an outgrowth of the foregut, the path of mitosis is normally a right-handed spiral, since this structure is a backward deflection of part of the esophagus.

Studies in the dynamics of histogenesis.—Growth motive force as a dynamic stimulus to the genesis of muscular and skeletal tissues, E. J. CAREY (*Anat. Rec., 19 (1920), No. 4, pp. 199–235, figs. 20*).—Growth motive force is defined as "any agency which tends to produce a transfer of kinetic energy from an active to a less active group of cells, and of potential energy from a less active to an active group, in a cellular field of differential growth until equilibrium is established." This concept is applied to the author's data concerning the embryonic growth of the colon of the pig as given in the first of the papers noted above and also to some as yet incomplete observations on the bone development in the hind limb.

The following factors are found to be important in the differentiation of muscles: (1) Tensional stresses elicited by force external to the differentiating muscle cells, (2) loss of water, (3) increase of viscosity, (4) increase of total titratable acidity. In the limb the early embryonic bone material is first distributed at the periphery on the convex side of the bent femur and later encircles the middle of the shaft. The relationship between accelerated skeletal growth and retarded mesenchyme development is considered in relation to the motive force of differential growth.

Experimental studies on growth, XV, XVI, T. B. ROBERTSON and L. A. RAY (*Jour. Biol. Chem., 42 (1920), No. 1, pp. 71–107, figs. 3; 44 (1920), No. 2, pp. 439–453, figs. 2*).—Two papers are added to this series (E. S. R., 41, p. 766).

XV. *On the growth of relatively long-lived compared with that of relatively short-lived animals.*—The control male and female white mice and four groups of experimentally fed males and five groups of experimentally fed females reported on in previous papers furnish the data here presented.

Pituitary, tethelin, cholesterol, and lecithin were the materials fed the different groups. After all the individual dying from known accidents or disease epidemics had been omitted, each group of animals was divided into two subgroups, one with longer and the other with shorter lives than the group average. Average weights at successive ages of the long-lived and the short-lived animals of each group, the percentage variability of the long-lived, and the variability of the group are presented in tables.

It was found that the long-lived animals of each group were highly resistant to environmental changes and were below the average in variability. They showed a tendency for a rapid growth in early life, whereas the short-lived animals tended to grow irregularly at later ages. It is argued that the potential longevity of any given individual is determined by the relative velocities of anabolism in the cellular and in the connective tissues. Tethelin would thus act to prolong life by aiding the cellular tissues in their competition for nutrients. If the administration of tethelin is discontinued prior to sexual maturity the normal tissue proportions are restored, and exceptionally large but relatively short-lived animals result.

XVI. *The influence of brain tissue, freed from cholesterol, upon the growth of the white mouse.*—Experiments with white mice were conducted to determine whether part of the stimulating effect of nerve tissue on body functions is due to a specific growth-promoting substance elaborated by the brain. Study XII (E. S. R., 41, p. 767) had shown that cholesterol tends to accelerate growth, and the mice were, therefore, fed with cholesterol-free brain tissue (ox). The experimental animals grew at a rate not sensibly different from the controls, and it is concluded that if such a hormone exists in the brain, it was dissolved out in the acetone used to extract the cholesterol.

Effect of subcutaneous injections of thymus substance in young rabbits, A. W. DOWNS and N. B. EDDY (*Endocrinology, 4 (1920), No. 3, pp. 420-428, figs. 3*).—Subcutaneous injections of large doses of desiccated thymus (Armour) checked the increase in weight of young rabbits, but did not otherwise retard development. The thyroid gland and the spleen became heavier and the thymus declined in weight.

Observations on the gaseous metabolism of castrated rabbits, H. BERTSCHI (*Biochem. Ztschr., 106 (1920), No. 1-3, pp. 37-55*).—The author finds that the gaseous metabolism of rabbits is not altered by the removal of testes or ovaries or by the subcutaneous injection of testicular or ovarian extract. Previous work had shown that the ablation of other glands of internal secretion (thyroid, thymus, spleen) had a marked effect on the respiratory exchange.

Observations on the follicular atresia in the rabbit ovary, G. ASAMI (*Anat. Rec., 18 (1920), No. 4, pp. 323-343, figs. 7*).—The author has studied the frequency of atresia in the follicles of the rabbit's ovary and finds that atresia occurs in follicles of all sizes and at all stages of the sexual cycle. There were no evidences of cyclic changes such as occur in the ovary of the guinea pig. In the medium-sized and large follicles the initial process of atresia consists in degeneration of the granulosa cells. In the small follicles the egg is more markedly affected than the granulosa.

The prenatal growth of the guinea pig, R. L. DRAPER (*Anat. Rec., 18 (1920), No. 4, pp. 369-392, figs. 5*).—The author presents and discusses a series of tables giving the weights and lengths of guinea pig embryos of known ages. Data on the weight of the uterus, the number of embryos, and the weight of the embryonic membranes and amniotic fluid are included.

Contribution to the embryology of Bos taurus L., E. MICHL (*Anat. Anz., 53 (1920), No. 8-9, pp. 193-215, figs. 8*).—This is a description of two early cattle fetuses, one 15.5 and the other 21 mm. long, with notes on the development of the eye, œsophagus, rumen, pelvic region, and other parts.

The feeding of farm animals, O. KELLNER, edited by G. FINGERLING (*Die Ernährung der Landwirtschaftlichen Nutztiere. Berlin: Paul Parey, 1919, 8. ed., pp. XII+667, pl. 1*).—This edition differs from the sixth (E. S. R., 30, p. 67) mainly by the addition of chapters or sections on bone glue as a source of nitrogen, silage and silage making, and the process of hydrolyzing straw by means of sodium hydroxid, together with descriptions of war-time substitute feeds, and notes on condimental feeds. The tables are unchanged except for the addition of a section on the composition of war-time substitutes.

Some new factors in the production of silage (*Wisconsin Sta. Bul. 319 (1920), pp. 41, 42*).—Brief mention is made of work on the bacteriology of silage by E. G. Hastings. It was found that the first organism which appears in any numbers in silage is one of the colon group. It produces carbon dioxid, acids in small amounts, and from 0.6 to 0.7 per cent of alcohol.

Peas were germinated and grown in test tubes under sterile conditions and then transferred to small containers and sealed. The resulting "silage" showed no trace of acid.

Cottonseed meal and hulls for feeding, J. E. HALLIGAN (*Feedingstuffs, 35 (1919), Nos. 3, pp. 22-24; 6, pp. 29, 30; 36 (1920), Nos. 3, pp. 25, 26, 55, 56; 4, pp. 37, 38, 55, 56; 5, pp. 47, 51; 6, pp. 43, 44, 48, 49, 52*).—This is a compilation of information concerning the use of cottonseed meal and hulls for feeding. Part 1 is concerned with the classification and composition of cottonseed products; part 2 reviews the experiments on the toxicity of cottonseed meal; part 3 consists of a bibliography of 254 titles; and the remaining sections review feeding experiments by various experiment stations.

Rice meal feeding experiments, S. N. SIL (*Bihar and Orisso Dept. Agr. Rpt., 1918–19, pp. 19, 20*).—In continuation of previous work (E. S. R., 43, p. 172), the author reports the gains of 3 lots of five 200-lb. calves during a feeding period of 9 weeks. Lot 1 gained 179 lbs. on 657 lbs. of rice meal, lot 2 gained 238 lbs. on 500 lbs. of rice meal and 176 lbs. of field peas, and lot 3 gained 256 lbs. on 516 lbs. of oats. Durra silage was fed to all the animals. The low cost of the rice meal made its use profitable.

Commercial feeding stuffs, S. H. WILSON and J. F. KING (*Ga. Dept. Agr. Mo. Bul., 7 (1920), No. 9, pp. 55*).—Analyses are reported of wheat bran, middlings, shorts, red dog, wheat mixed feed, rice bran, rice polish, rice meal, cottonseed feed and meal, ground barley, corn meal, hominy feed, peanut meal, alfalfa meal, dried beet pulp, and meat scrap.

Inbreeding animals, F. A. HAYS (*Delaware Sta. Bul. 123 (1919), pp. 5–49, figs. 9*).—The author reports observations on the influence of inbreeding on Guernsey cattle and Berkshire swine and presents an extensive literature review of inbreeding in laboratory and farm animals, with a bibliography of 50 titles.

The Guernsey data were derived from the station herd. The milk records of the first 10 months of each lactation were corrected to a standard age by means of Pearl's dairy efficiency table (E. S. R., 37. p. 775) and inbreeding was measured by Pearl's coefficient of total inbreeding (E. S. R., 38, p. 269). Inbreeding was not marked except in the case of one or two animals. There seemed to be little relationship between the degree of inbreeding and the ability of daughters to produce more milk than their dams. There was some indication that inbreeding increased the proportion of males, but the data are not numerous.

The Berkshire experiments extended over 10 years, but owing to hog cholera and other accidental circumstances the work was carried on intensively for only four years. Data were secured from 108 inbred litters and a number of outbred and crossbred litters. It is concluded that inbreeding of pigs tends to decrease the certainty of pregnancy and to increase the mortality among the pigs. Inbred litters were smaller than the outbred or the crossbred ones, but the average birth weight of a pig was somewhat greater. The inbred pigs grew much more slowly. The data also indicate a tendency for an excess of males in inbred litters.

[Live-stock breeding in French colonies], DECHAMBRE ET AL. (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 4, pp. 343–566*).—These pages include the following papers presented before the section on breeding of the Congrès d'Agriculture Coloniale held in May, 1918: General account of the breeding situation in the colonies, by Dechambre (pp. 343–361); cattle, sheep, and swine in Tunis (pp. 362–368); the live-stock resources of Morocco, by Greffhule (pp. 369–384); the animal products of French West Africa, by Pierre (pp. 385–482); the breeding of cattle in Madagascar, by Carougeau (pp. 483–497); breeding in Madagascar—draft animals and domestic animals, by G. Grandidier (pp. 498–527); beef production in Madagascar, by Hesling (pp. 528–541); pasturage for stock in Madagascar, by Carle (pp. 542–556); and summary of studies on the breeding of the horse in Madagascar, by Geoffroy (pp. 557–566). The papers are mainly statistical in nature.

Inheritance of milk and meat production in cattle (*Wisconsin Sta. Bul. 319 (1920), pp. 53, 54*).—In experiments involving crosses between the Jersey and the Aberdeen Angus breeds, L. J. Cole found that the first generation were all black and polled, but in other respects were intermediate between the two parent breeds. Segregation in color and horn characters occurred in the

second generation. Some of the polled individuals bore loose scurs, this being particularly true of the males.

Fattening native steers for market: 1920, R. H. WILLIAMS (*Arizona Sta. Bul. 91 (1920), pp. 355–396, figs. 6*).—The author reports a 77-day feeding experiment beginning January 9, 1920, with 36 890-lb. steers. Nine of these were high-grade Holsteins and the others the offspring from mating a Polled Shorthorn bull to grade Holstein cows. The steers were divided into lots of six. Lot 1, which was composed exclusively of Holsteins, received alfalfa hay alone (average ration of 28.63 lbs. per head) and gained 1.4 lbs. per head per day. Lot 2, on an average ration of 9 lbs. of alfalfa hay and 47.1 lbs. of silage, made an average daily gain of 2.39 lbs. Lot 3, fed 61.8 lbs. of silage and 2.66 lbs. of cottonseed meal per day, made a daily gain of 1.96 lbs. Lot 4, fed 4.2 lbs. of alfalfa hay, 60.7 lbs. of silage, and 2.66 lbs. of cottonseed meal, made the best gain, 2.55 lbs. per day. Lot 5, fed 52.7 lbs. of silage, 5.7 lbs. of ground milo, and 2.66 lbs. of cottonseed meal, gained 2.47 lbs. per day; and lot 6, fed 4 lbs. of alfalfa hay, 48.4 lbs. of silage, 5.8 lbs. of ground milo, and 2.66 lbs. cottonseed meal, made the second best gain, 2.49 lbs. per day and had the highest dressing percentage.

For 40 days following the close of the main experiment 4 steers from lot 1 and 5 from lot 2 were continued in the feed lot and were fed alike on cottonseed meal, silage, and alfalfa hay. At the beginning of the supplemental experiment the lot 2 steers averaged 40 lbs. heavier than those in lot 1, but the latter gained more rapidly and at the end of the period were only 4 lbs. lighter.

Sorghum silage was used in the main experiment except during the last 10 days when corn silage was substituted. The proximate composition of ground hegari and of each of the feeds offered are tabulated, and data are included as to the shrinkage of the steers and the influence of size on the rate of gain and the finish.

[Steer feeding without corn grain] (*Wisconsin Sta. Bul. 319 (1920), pp. 71, 72*).—A feeding trial with two lots of 10 steers each was conducted by J. G. Fuller and F. B. Morrison. The lot fed an average ration of 12.5 lbs. of shelled corn, 2.8 lbs. of cottonseed meal, 32.6 lbs. of silage, and 2.2 lbs. of mixed hay made an average daily gain of 2.81 lbs. per head. The other lot, which received 3.6 lbs. of cottonseed meal, 55.6 lbs. of silage, and 2.6 lbs. of mixed hay, made substantially the same gain. The corn-fed lot showed somewhat better finish, shrank somewhat less in transit, and had a somewhat higher dressing percentage.

Australasian sheep and wool, A. HAWKESWORTH (*Sydney: William Brooks & Co., Ltd., 1920, 5. ed., rev. and enl., pp. XVI+594, pl. 1, figs. 102*).—This volume is a treatise on sheep breeding and wool production in Australia and New Zealand, and covers a large number of topics including descriptions of British breeds, methods of crossbreeding, suggestions for feeding and management, pasture management, the structure of the wool fiber with particular reference to spinning capacity, the types of wool, classifying and sorting combing wools, fellmongery, and the manufacture of woolen textiles. A number of glossaries of terms used in sheep breeding and in classifying and manufacturing wool are included, as well as statistics on the sheep and wool industries of Australasia.

[Barley, skim milk, and whey for hogs] (*Wisconsin Sta. Bul. 319 (1920), pp. 67, 68, 70, 71*).—Average results of two experiments by F. B. Morrison and G. Bohstedt are summarized. The details of one experiment have been noted from another source (E. S. R., 43, p. 774).

In comparing barley and tankage *v.* corn and tankage, it was found that the barley-fed pigs consumed 15 per cent more grain, but only about 75 per cent as much tankage per unit gain as the corn-fed pigs.

In the skim milk and whey comparisons, made with hogs weighing from 125 to 150 lbs., barley and tankage (free choice) produced a daily gain of 1.64 lbs. per head, and 4.5 lbs. of barley and 0.23 lb. of tankage were required per pound of gain. Lots receiving barley and a limited feed of skim milk made a daily gain of 1.89 lbs. and consumed 4.06 lbs. of barley and 3.4 lbs. of skim milk per pound of gain. Lots fed barley and whey (free choice) gained 2.22 lbs. per head per day and consumed 3.53 lbs. of barley and 8.5 lbs. of whey per pound of gain. Hart and Steenbock (E. S. R., 42, p. 265) have recently shown that protein mixtures containing whey or skim milk have a high productive value.

Barley v. oats for work horses (*Wisconsin Sta. Bul. 319 (1920), pp. 68, 69*).—F. B. Morrison, G. Bohstedt, and J. G. Fuller in an experiment with 10 teams of work horses found that ground barley was about 10 per cent more efficient than crushed oats of equal quality.

Inheritance of color in horses, Ø. Winge (*Nord. Jordbrugsforsk., 1920, No. 1, pp. 1–30*).—After reviewing the results of previous investigators, the author summarizes data secured from the studbook of the Jutland breed of Danish horses.

It is concluded that the bay horse carries the factors *R* and *S* characteristic, respectively, of the chestnut and of the black horse. About 40 per cent of the bays were homozygous for *R* and 10 per cent for *S*. As in other breeds, gray color and piebald pattern seem to be due to dominant factors.

The French-Canadian horse, G. Langelier (*Canada Expt. Farms Bul. 95 (1920), pp. 21, figs. 6*).—This is a description of the history and uses of the French-Canadian horse, an account of breeding work instituted at the Cap Rouge, Quebec, Station and elsewhere, and an outline of development work to be undertaken in cooperation with breeders.

Acquired skeletal deformities in a young fowl, E. D. Congdon (*Anat. Rec., 19 (1920), No. 3, pp. 165–172, figs. 6*).—Skeletal peculiarities are described of a White Leghorn cockerel kept in cramped quarters (incubator) from hatching until killed about three months later. The trunk was much flattened and was bent at the pelvis and the sternum; the neck was increased in volume and the ribs and several other bones were thickened. The character of some of the deformities suggested rickets, but no detailed examination of this point was made.

Principles of poultry feeding, W. F. Schoppe (*Montana Sta. Circ. 91 (1920), pp. 16, fig. 1*).—This is a popular treatise on poultry feeding.

How to balance the poultry rations, Mr. and Mrs. G. R. Shoup (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 7, pp. 106–110*).—This general discussion includes a table compiled from various sources, giving the average composition and digestibility of 47 poultry feeds.

Ways and means of feeding the laying hens, W. C. Thompson (*New Jersey Stas., Hints to Poultrymen, 9 (1920), No. 2, pp. 4, fig. 1*).—The author suggests methods of feeding laying hens, particularly in the winter, and describes the New Jersey "more mash" hopper.

The economics of artificial illumination, H. R. Lewis (*New Jersey Stas., Hints to Poultrymen, 9 (1920), No. 1, pp. 4, fig. 1*).—The author describes the methods used in the artificial illumination of poultry houses and the "evening lunch" method of feeding.

Profits from farm poultry flocks in Missouri for 1919, T. S. Townsley (*Missouri Agr. Col. Ext. Circ. 84 (1920), pp. 4*).—This is a report on the profits on demonstration poultry farms in Missouri for the year ended October 31,

1919. The data include average records by months of egg production, feed costs, and income from fowls and eggs and the yearly average of feed consumption, egg prices, cost of raising chicks, changes in inventory values, interest and depreciation, etc.

The average number of hens per flock was 134. The annual egg yield averaged 106.3 eggs and the labor income $2.78 per hen. On the farm with the best record there were 477 hens in the flock; the egg production per hen was 160 eggs and the labor income $5.09.

Incubation of hens' eggs, H. M. LAMON (*U. S. Dept. Agr., Farmers' Bul. 1106 (1920), pp. 8, figs. 5*).—The natural incubation of eggs, the care of the sitting hen, and methods of testing eggs are described for the use of members of boys' and girls' poultry clubs.

Management of growing chicks, J. W. KINGHORNE (*U. S. Dept. Agr., Farmers' Bul. 1111 (1920), pp. 6, figs. 2*).—Designed for the use of members of boys' and girls' poultry clubs.

[Weed seeds for young chicks] (*Kansas Sta. Rpt. 1919, p. 65*).—As a part of a project to determine the desirability or danger of chick feeds which include weed seeds, it was found that chicks refused seeds of the following plants even when they are kept hungry: Wild oats, wild buckwheat, Indian mustard, lamb's-quarter, hare's-ear mustard, corn cockle, ball mustard, wild pepper grass, stinkweed, Mexican tea, sleepy catch fly, quack grass, charlock, large crab grass, stickseed, water smartweed, curled dock, western wheat grass, and cheat.

The handling and packing of market eggs, G. H. POUND (*New Jersey Stas., Hints to Poultrymen, 9 (1920), No. 5, pp. 4, fig. 1*).—This consists of advice in crating and packing eggs.

Packing eggs for market shipment, A. L. CLARK and W. L. HUNDERTMARK (*N. J. Dept. Agr. Circ. 32 (1920), pp. 15, figs. 10*).—This publication consists of illustrated directions for crating eggs, with notes on the use and repair of second-hand crates. The importance of the middle pad is emphasized.

Preserving eggs, J. W. KINGHORNE (*U. S. Dept. Agr., Farmers' Bul. 1109 (1920), pp. 7, figs. 3*).—Methods of using water glass and lime solutions are described for the use of members of boys' and girls' poultry clubs.

DAIRY FARMING—DAIRYING.

Heavy v. light grain feeding for dairy cows, F. W. WOLL, E. C. VOORHIES, and C. V. CASTLE (*California Sta. Bul. 323 (1920), pp. 3–21, fig. 1*).—This is a report of three experiments conducted in 1919 and 1920. In two experiments grain feeding at the rate of 1 lb. for each 5 lbs. of milk was compared with a ration of 1 lb. of grain per 3 lbs. of milk. In the third experiment a light and a heavy grain ration were also compared, the amounts being proportional to the butter-fat production. From 14 to 26 cows were used in each experiment. They were divided as fairly as possible into two groups and fed by the reversal method during two periods of 5 or 6 weeks.

In the first experiment the cows on a light grain ration produced slightly more milk and butter fat than those on a heavy ration, but in the other two experiments the heavy grain ration resulted in the higher production. When the results from all three experiments were averaged, it was found that the cows on the light grain ration produced 21.8 lbs. of milk and 0.859 lb. butter fat per day, while those on the heavy rations produced 22.8 lbs of milk and 0.894 lb. of butter fat per day. It is concluded that the increased production from the heavy rations is so slight that their use is not economical.

Barley v. corn for milch cows (*Wisconsin Sta. Bul. 319* (*1920*), *p. 68*).—A brief report is made of two experiments by F. B. Morrison, G. C. Humphrey, and R. S. Hulce.

In the first, 2 lots of 6 cows were fed by the reversal method during 2 periods of 6 weeks each. When ground barley was fed to the extent of 60 per cent of the grain ration, the average daily milk yield was 25.1 lbs. and the butter-fat yield 0.92 lb. With corn in place of barley the milk yield averaged 25.6 lbs. and the butter fat 0.94 lb. The cows gained in weight on the barley feeding and lost during the corn feeding.

In the second experiment 2 lots of 5 cows on pastures were fed by the reversal method during 3 periods of 5 weeks each. During the period of barley feeding (barley, bran, and cottonseed meal, 6:3:1) the daily milk production averaged 26.9 lbs. and the butter-fat production 0.96 lb. When corn was fed in place of barley each cow averaged 26.3 lbs. of milk and 0.94 lb. of butter fat per day. The animals gained in weight slightly on the corn ration and lost on the barley ration.

[**Dairy cattle feeding at the Kansas Station**] (*Kansas Sta. Rpt. 1919, pp. 58–61*).—Results from the heifer development project indicated that an exclusive feeding of alfalfa hay did not impair the breeding powers of heifers, but that for maximum production and economy it was necessary to add silage to the ration. Heifers bred to calve at the age of 24 months lacked size and matured more slowly than those bred to calve at 30 months.

In a study of white sweet clover pasture, it was found that one acre of second year's growth would maintain a cow for 5.3 months when grain was fed. No case of poisoning was observed.

The self-feeder for dairy calves, W. B. Nevens (*Jour. Dairy Sci.*, *2* (*1919*), *No. 6, pp. 435–443, figs. 5*).—The author presents feeding and growth records from birth to six months of age of nine Holstein calves raised in separate stalls at the Nebraska Experiment Station.

Skim milk was gradually substituted for whole milk after three weeks and was given throughout the experiment, the maximum ration being 16 lbs. Dry feed was given as soon as the calves would eat it. Alfalfa hay and a grain mixture were kept constantly in five of the stalls, while the remaining calves were fed twice a day all the alfalfa hay and grain they would clean up.

The self-fed calves averaged 97 lbs. at birth and gained 393.4 lbs. per head in the six months. The birth weight of the hand-fed calves averaged 81.3 lbs. and their gain 283.5 lbs. Per pound of gain the self-fed group consumed 2.59 lbs. of digestible nutrients and the hand-fed group 2.47, but the grain mixture in the two cases was different. The height at withers, width at hip, and heart girth were greater in the self-fed calves. No digestive disturbances were noted, and it is concluded that self-feeding should be seriously considered as a labor-saving device in calf feeding.

Heredity and production, R. R. Graves (*Hoard's Dairyman*, *60* (*1920*), *No. 18, pp. 785, 798, 799*).—In this address, delivered at a meeting of the Connecticut Breed Associations, the speaker pointed out that type in dairy cows is a less important matter than production and discussed the problem of inbreeding.

The correlation between milk yield of one lactation and that of succeeding lactations, J. W. Gowen (*Maine Sta. Bul. 289* (*1920*), *pp. 121–132*).—This is an abstract of the last sections of the fifth of the author's studies in milk secretion, already noted (E. S. R., 43, p. 676).

The variation of butter-fat percentage with age in Jersey cattle, J. W. Gowen (*Maine Sta. Bul. 290* (*1920*), *pp. 133–144*).—This and the following bulletin form an abstract of the sixth of the author's studies in milk secretion (E. S. R., 44, p. 178).

The correlation between the butter-fat percentage of one lactation and the butter-fat percentage of succeeding lactations in Jersey cattle, J. W. Gowen (*Maine Sta. Bul. 291 (1920), pp. 145–156*).

Neglect of details in care of milking machines results in low-grade milk, J. D. Luckett (*New York State Sta. Bul. 472, pop. ed. (1920), pp. 3–13, pls. 4, figs. 4*).—This is a popular edition of the bulletin by Bright previously noted (E. S. R., 43, p. 679).

Cooperative city milk plants (*U. S. Dept. Agr., Bur. Markets, Marketing Dairy Prod. Circ. 1 (1920), pp. 2; also in Creamery and Milk Plant Mo., 9 (1920), No. 6, pp. 30, 31, 44*).—The capitalization, physical assets, and volume of business are tabulated of 14 cooperative associations of milk producers, or of producers and dealers, organized in the United States for the purpose of wholesale or retail distribution of milk.

The necessity of taking a composite sample of milk when grading raw milk by numerical bacterial content, R. S. Dearstyne and L. R. Jones (*Jour. Dairy Sci., 2 (1919), No. 6, pp. 504–508*).—In a series of milk samples collected from eight dealers it was found that samples taken from the night milk, presumably 12 hours older than the morning milk, consistently showed a higher count than the latter. It is pointed out that milk inspectors should be careful to collect both morning and night milk from each dealer.

Occurrence of the colon-aerogenes group of organisms in raw and in pasteurized milk, and its significance, R. Finkelstein (*Jour. Dairy Sci., 2 (1919), No. 6, pp. 460–481*).—The author has studied the colon-aerogenes content of raw milk produced at the Ontario Agricultural College, raw milk sold in Guelph, raw milk received at the college pasteurizing plant and a commercial pasteurizing plant, and milk pasteurized in both of these plants.

It is concluded that the initial contamination of raw milk with this group of bacteria averages less than 100 per cubic centimeter when appropriate care is used in production. Under careless management the average count was 588 per cubic centimeter. The growth of these organisms in raw milk was checked by a temperature of 50° F. or lower, while temperatures above 60° caused them to grow rapidly. Fresh cold milk, carefully produced, contained from 600 to 4,000 liquefiers per cubic centimeter, while milk from average farms indifferently cooled contained from 30,000 to 500,000 liquefiers.

Proper pasteurization by the holding method destroyed practically all the colon-aerogenes organisms, leaving an average of only 42 per cubic centimeter and some samples showed none. The critical temperature appeared to be 145°. Proper pasteurization also reduced the liquefying organisms, thus permitting the lactic acid bacteria to control the subsequent fermentation.

The colon-aerogenes count on aesculin-bile-salt agar immediately after pasteurization is considered a valuable supplement to the agar plate count in pasteurization control. It is suggested that grade A pasteurized milk should contain less than 50 colon-aerogenes organisms per cubic centimeter and grade B pasteurized less than 100.

A municipal pasteurizing and bottling plant is considered desirable for cities the size of Guelph (20,000 inhabitants).

On the rate of growth of lactic acid bacteria at different H-ion concentrations, O. Svanberg (*Hoppe-Seyler's Ztschr. Physiol. Chem., 108 (1919), No. 3, pp. 120–146, figs. 4*).—*Streptococcus lacticus* from milk was found to have optimum growth between pH=5.5 and pH=6.4, and the growth rate decreased markedly when the acidity became lower. *Bacterium casei* ε and *B. delbrücki* grew best within the limits pH=5 and pH=6.

The acidity of ropy milk, K. FREEAR and E. C. V. VENN (*Biochem. Jour., 14 (1920), No. 3-4, pp. 422–431, figs. 7*).—The authors isolated two strains of bacteria from ropy milk and found that they produced ropiness when inoculated in normal milk. The ropiness continued for varying periods as long as the acidity remained low (pH range of 5.82 to 4.1). After the ropiness disappeared there was no appreciable increase in the acidity of the milk.

From cultural characteristics it is concluded that these organisms were identical with or closely related to *Streptococcus hollandicus*, and they were successfully used as starters for Edam cheese.

Further investigations of the casein-splitting capacities of the lactic acid bacteria belonging to the Streptococcus lactis group, C. BARTHEL and E. SANDBERG (*Meddel. Centralanst. Försöksv. Jordbruksområdet, 171 (1918), pp. 24; also in K. Landtbr. Akad. Handl. och Tidskr., 57 (1918), No. 5, pp. 331–352; Centbl. Bakt.* [etc.], *2. Abt., 49 (1919), No. 14–17, pp. 392–412*).—The authors have studied the ability of 22 strains of lactococci isolated from milk, whey, starters, etc., to hydrolyze casein in skim milk cultures containing enough calcium carbonate to neutralize all the lactic acid capable of being produced by the lactose present. The soluble nitrogen produced in two months varied from 0 to 23 per cent and remained practically constant for a given strain. Strains of lactococci without casein-splitting power had a marked proteolytic effect in the presence of rennet.

Experimental cheeses were made under sterile conditions from milk inoculated with pure cultures of the lactococci, alum being substituted for rennet. In most cases there was a marked proteolytic action. In one case where the splitting was slight, the H-ion concentration was abnormally low.

Observations on Bacterium casei δ von Freudenreich, R. BURRI and W. STAUB (*Landw. Jahrb. Schweiz, 32 (1918), No. 5, pp. 624–637*).—This is a study of the cultural and morphological characters of the types of lactobacilli occurring in Emmental cheese and not belonging to *B. casei α* or *B. casei ε*. These were mostly typical *B. casei δ*, but there were two aberrant types which are also considered members of the δ-group.

The rods are nonmotile and in liquid media grow into long threads. They differ from ordinary lactic acid bacteria in producing gas and in failing to curdle milk rapidly. The gas was found to be mainly CO_2 and not hydrogen as stated by Orla-Jensen. Growth takes place at 45° C. but not at 50°, and the cultures were killed by heating to 65°.

The microbial flora of the whey of Grana cheese, G. DALLA TORRE (*Staz. Sper. Agr. Ital., 51 (1918), No. 9–12, pp. 317–354*).—A large number of rod-shaped organisms resembling the various types of von Freudenreich's *Bacterium casei* were isolated from the whey of Grana cheese and studied in cultures. Two main groups are recognized: (1) Gas producers which may or may not coagulate milk rapidly, and (2) rapid coagulants that do not generate gas. The cheese was of poor quality when the former group was abundant in the whey. The use of selected cultures is advocated to control the fermentation.

Relation of the enzyms of butter to the production of tallowiness by copper salts and over-neutralization, L. S. PALMER and W. B. COMBS (*Jour. Dairy Sci., 2 (1919), No. 6, pp. 444–452*).—In experiments at the Missouri Experiment Station tallowy butter was produced by the addition of 0.017 per cent of copper lactate to the cream. In each case the defect became noticeable in butter made from raw cream sooner than in butter from cream pasteurized at 79 or 80° C., a temperature known to destroy all but the proteolytic enzyms in milk as shown by the work of Rogers et al. (E. S. R., 29, p. 71). Over-neutrali-

zation of the cream with sodium hydroxid did not accelerate the appearance of tallowiness. It is concluded that the natural oxidases of butter are the chief agents in the production of tallowiness and not, as suggested by Hunziker and Hosman (E. S. R., 39, p. 785), the oxidation products resulting from the hydrolysis of the neutral fat.

"Whatever may be the chemical changes underlying the tallowy decomposition of butter, the results at least suggest the practical application of high temperature pasteurization in retarding the development of tallowiness in butter which has been contaminated with metallic salts."

Tallowiness is accompanied by a characteristic bleaching of the natural butter color, and attention is called to the work of Zilva (E. S. R., 42, p. 59) who found that bleached butter had lost its fat-soluble vitamin.

The catalase content of cheese, J. M. SHERMAN (*Jour. Dairy Sci., 2 (1919), No. 6, pp. 453–459, figs. 2*).—The author reports determinations made in the Dairy Division, U. S. Department of Agriculture, of the relative catalase content of 4 samples of imported and 14 samples of domestic Swiss (Emmental) cheese and 24 Cheddar cheeses, of which 8 were made from pasteurized milk. The Swiss types were distinctly richer in catalase than the raw milk Cheddar, and the latter contained more than the pasteurized Cheddar.

A high catalase-producing organism was found to occur in large numbers in Swiss cheese. It was isolated, and inoculation experiments showed that it increases the catalase content of cheese when added to the milk previous to manufacture.

Pepsin v. rennet in cheese making, H. M. MERKER (*Jour. Dairy Sci., 2 (1919), No. 6, pp. 482–486*).—The author states that pepsin has almost entirely replaced rennet in the manufacture of hard cheese throughout the world, and that experienced cheese makers find that pepsin does not cause abnormal loss of butter fat in the whey. Data are cited showing the activation of pepsin by soluble calcium salts ($CaCl_2$ and $CaHPO_4$).

[Experiments with dairy products at the Wisconsin Station] (*Wisconsin Sta. Bul. 319 (1920), pp. 43, 44*).—To overcome the lack of flavor of Cheddar cheese made from pasteurized milk, E. G. Hastings and J. L. Sammis used a special starter which in addition to the lactic acid bacteria contains organisms isolated from soil and feces. The cheese developed flavor more rapidly than the control cheese made from pasteurized milk with ordinary starter.

H. H. Sommer found that the titratable acidity of milk is not an indication of its coagulability when sterilized, and that condenseries are, therefore, not justified in refusing milk of high acidity. Coagulation is primarily due to excess of soluble calcum salts, and any tendency to coagulate can be readily corrected by the addition of suitable citrates or phosphates.

The milk condensery in Argentina and its beneficial effect on the Italian dairy industry, A. M. CABIZZA (*Agr. Colon. [Italy], 14 (1920), No. 8, pp. 321–325, fig. 1*).—This article deals with the manufacture of a readily soluble milk powder in Argentina and the importation of the product to Italy for use in cheese making and for manufacturing reconstructed milk.

The condensed milk and milk powder industries, F. W. BAUMGARTNER (*Queen's Univ. Ontario, Depts. Hist. and Polit. and Econ. Sci. Bul. 36 (1920), pp. 32*).—This is a compilation outlining recent developments in the manufacture of condensed milk and milk powder. Data on production and prices are included.

VETERINARY MEDICINE.

Report of the Civil Veterinary Department, Assam, for the year 1919–20, W. HARRIS (*Assam Civ. Vet. Dept. Rpt., 1919–20, pp. 2–17*).—This is the usual annual report (E. S. R., 41, p. 874).

St. John's wort and its action on live stock, S. DODD (*Jour. Compar. Path. and Ther., 33 (1920), No. 2, pp. 105–114*).—This is a report of experiments conducted at the Veterinary Pathological Laboratory of the University of Sydney, New South Wales, with *Hypericum perforatum*. This is a common perennial weed in many countries, and once it has established itself in a pasture is difficult to eradicate, being a very hardy perennial. Feeding experiments briefly reported confirm the opinions arrived at by other workers as to the injurious results of the ingestion of this plant, particularly in its flowering stage.

An experimental study of echinacea therapy, J. F. COUCH and L. T. GILTNER (*Jour. Agr. Research [U. S.], 20 (1920), No. 1, pp. 63–84*).—This paper, contributed from the Bureau of Animal Industry, U. S. Department of Agriculture, consists of a brief historical review of the use of echinacea as a remedy for various disorders, followed by the report of an extensive investigation conducted on guinea pigs to determine whether alcoholic preparations of echinacea have any value as a remedy in several pathological conditions induced by bacteria, their products, or allied toxins. These included tetanus, botulism, anthrax, septicemia, and crotalus poisoning, also chronic tuberculosis and dourine. In some cases animals were injected with the pathogenic material and were then treated with large daily doses of echinacea, while in others the animals were treated with echinacea for several days before being injected with pathogenic material, and the treatment then continued as long as possible.

In none of the diseases thus treated was any evidence obtained that the plant exerts any influence upon the course of the disease under laboratory conditions. The daily feeding with echinacea preparations for several days before injection of the microorganisms or their toxins did not increase the resistance of the animals. In all cases the course of the disease was the same in the control animals and in the animals which were given echinacea treatment. It is, therefore, concluded that preparations of echinacea are of no value in the treatment of diseases produced by microorganisms and their toxic products.

The germicidal value of potassium mercuric iodid, D. MACFARLAN (*Amer. Jour. Med. Sci., 159 (1920), No. 4, pp. 586–592*).—Attention is called to four properties of potassium mercuric iodid which make it superior as a germicide to other salts of mercury and iodin. These are its ready solubility in water alcohol, and acetone; its comparatively low toxicity; its lack of irritation; and its lack of affinity for serum proteins.

Tests of the germicidal action of the salt upon various microorganisms in simple broth cultures and in the presence of serum proteins are reported. Cultures of *Staphylococcus albus* were killed in 5 minutes by a 1:5,000 solution and in 2 hours by a 1:1,500 solution, thus indicating that the double iodid can be effectively used in dilutions incapable of producing irritation to the most sensitive tissues. Sporulating cultures of *Bacillus subtilis* were killed within 5 minutes by a 1:500 solution of the salt.

Organic matter in the form of human serum albumin in a concentration of 0.5 per cent had no appreciable effect on the germicidal action of 1:500 and 1:5,000 solutions. With weaker solutions of the germicide a slight delay in bactericidal action was caused by the protein. The author concludes that potassium mercuric iodid is the most desirable of the inorganic germicides.

Development of the bactericidal power of whole blood and antibodies in serum, J. H. Black, K. Fowler, and P. Pierce (*Jour. Amer. Med. Assoc.*, *75* (*1920*), *No. 14*, *pp. 915–919*, *figs. 8*).—The work reported in this paper was undertaken to determine whether the method of Heist and the Solis-Cohens for estimating the bactericidal property of blood (E. S. R., 40, p. 286) could be used in demonstrating the progress of the development of an artificially induced immunity, and also to determine whether any relationship exists between the bactericidal titer of the whole blood and the antibodies in the serum and whether the method throws any light on the mechanism of the bactericidal action.

Typhoid and dysentery (Shiga) bacilli were used with rabbits as experimental animals. Control tests were made before the immunization was begun. For the typhoid injections an autolyzate was used, and for the dysentery a suspension of washed bacilli, killed with heat. Injections, either subcutaneous or intravenous, were made every 5 days in doses of 20,000,000 organisms per kilogram of body weight. Five and 20 days after the last injection the bactericidal titer of the blood was compared with simultaneous determinations of the batericidal titer of the serum, complement fixation, agglutination, leucocyte count, and phagocytic index.

The results obtained in general confirm the conclusions of Heist and the Solis-Cohens that the bactericidal power of the blood is a dependable criterion of the actual immunity of the animal. The route of inoculation made no difference in the rapidity or height of the development of the bactericidal power. The bactericidal titer of the serum, while developing somewhat more slowly than that of the blood, ultimately reached and maintained the same level. The leucocyte count and the phagocytic index proved to be unreliable criteria for judging the degree of immunity. The agglutination and complement fixation reactions, while representative in a general way, were only roughly comparable to the bactericidal power.

Lysis took place in the immunized rabbits with such rapidity that no evidence could be secured as to the mechanism of the action. Citrating and defibrinating the blood and inactivating the serum did not affect the bactericidal activity except in prolonging slightly the reaction.

Contaminating organisms were found to grow luxuriantly in the blood of typhoid and dysentery immune animals. Reducing the incubation time to 1 hour did not interfere with the destruction of the organism, but did assist in keeping down the contaminating bacteria.

The fate of killed nonhemolytic streptococci injected into the blood, and the resulting cellular changes, K. Nagao (*Jour. Infect. Diseases*, *27* (*1920*), *No. 4*, *pp. 327–362*, *pl. 1*).—This is a detailed report of investigations by the author at the John McCormick Institute for Infectious Diseases, Chicago.

Further observations on varieties of streptococci with reference to hemolysis, B. J. Clawson (*Jour. Infect. Diseases*, *27* (*1920*), *No. 4*, *pp. 368–377*).—"Hemolytic strains of streptococci when kept on suitable medium may retain the hemolytic property for at least 3 years. The method recommended by the Medical Department of the United States Army does not seem to have any advantage over the plating method on the blood-agar plate in determining the degree of hemolysis. It seems possible to miss hemolytic strains by the Army method when they can be detected by the plating method. Sheep blood, while it lakes slightly more readily than rabbit blood, can be used with equal efficiency in either the recommended Army method or the plating method.

"Typical hemolytic strains after being grown on artificial medium from 6 months to 3 years may produce colonies which show a green color about the

colony similar in all appearances to the colonies of *Streptococcus viridans*. The appearance of these green colonies tends to be associated with a weakening in the ability of strains to hemolyze, as is shown by the degree of hemolysis produced by the Army method and the smallness of the size of the hemolyzed zone about the colony on the blood-agar plate. All of the 50 hemolyzers tested produced a green discoloration of the sheep red cells on heated blood similar in all respects to the green produced by nonhemolyzers. This green-colored substance seems to be methemoglobin, when compared with the green produced on the blood-agar plate by *S. viridans* and according to the spectroscopic test. Methemoglobin is more readily produced by hemolytic strains of streptococci in heated blood than in nonheated blood."

Bacillus perfringens: Toxin and antitoxin production, A. H. W. Caulfeild (*Jour. Infect. Diseases, 27 (1920), No. 2, pp. 151–164*).—This paper consists of observations concerning the production and standardization of an antiserum to *B. perfringens* and a combined antiserum to *B. perfringens* and *B. tetani*.

The production and experimental use of botulinus antitoxin, types "A" and "B," G. H. Hart and F. M. Hayes (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 6, pp. 638–652*).—Botulinus antitoxin of types A and B was prepared in large quantities by the hyperimmunization of horses and used in experimental work to determine its therapeutic value, particularly against the syndrome produced by the administration of botulinus toxin and in natural outbreaks of forage poisoning. The experimental work reported includes, in addition to the details of the hyperimmunization experiments for the preparation of the serum, tests with chickens, horses, and cattle, the results of which may be summarized as follows:

Chickens proved to be somewhat more resistant to the toxin (type A) than guinea pigs in proportion to body weight when injected subcutaneously. A considerably larger dose of toxin was required when administered orally than when injected subcutaneously. The type B antitoxin proved to have some protective value for chickens following the administration of the corresponding toxin but before the appearance of symptoms. Some degree of immunity was apparently secured by the toxin-antitoxin treatment. The action of both types of toxin proved to be quite variable, although the chickens were more susceptible to type A than to type B.

Horses proved more susceptible to the toxin (type A) when injected subcutaneously than guinea pigs in proportion to body weight. Typical symptoms of forage poisoning were produced in two horses by repeated feeding of type A toxin with barley. Intravenous injection of a fairly potent antitoxin of the same type was without effect. The failure of the antitoxin as a therapeutic measure was further demonstrated by various field observations.

Cattle proved quite resistant to the toxin, although not entirely immune, as shown by the death of one yearling heifer subsequent to the subcutaneous injection of a large dose of the material.

The authors conclude that the field of usefulness for botulinus antitoxin will largely be confined to its prophylactic administration to animals on the same feed after one or more cases of the disease appear, but that it may have limited usefulness in preventing the fatal termination of the disease if administered soon after the appearance of the first symptoms.

The length of time which Piroplasma bigeminum and Anaplasma centrale survive in citrated blood, E. M. Robinson (*So. African Jour. Sci., 16 (1920), No. 4, pp. 347–353*).—The experiments here reported indicate that *P. bigeminum* in blood drawn from an immune animal will not survive in citrated

blood for a period longer than 24 hours, but may survive for that length of time. *A. centrale*, however, will practically always survive for at least 144 hours in citrated blood if the proportion is not more than 10 of citrate solution to 90 of blood.

Notes on thick film method of staining piroplasms and anaplasms in routine veterinary diagnostic work, A. GOODALL (*Jour. Compar. Path. and Ther., 33 (1920), No. 2, pp. 103–105*).—This is a brief report on results obtained by the author, in which the technique and advantages of the thick film method are pointed out. The author is convinced that in piroplasmosis the thick film method is superior for diagnostic purposes to any other, for in thin films the parasites are rarely encountered in large numbers.

Blackleg investigations (*Kansas Sta. Rpt. 1919, pp. 69, 70*).—In continuation of the blackleg studies previously reported by Goss (E. S. R., 42, p. 74), the efficacy of blackleg filtrate was further proved by immunization experiments with calves, those receiving the filtrate being immunized as thoroughly as those receiving the aggressin.

Attempts to develop a method of standardization of the filtrate indicate that it may be accomplished by testing normal horse serum against varying doses of filtrate and aggressin and blackleg virus. Efforts to find laboratory animals suitable for testing blackleg filtrate and aggressin have thus far proved unsuccessful, as guinea pigs do not act uniformly, and white rats and white mice have proved to be naturally immune to blackleg.

An anatomo-pathological study of the tongue lesions in foot-and-mouth disease in cattle, T. H. MOREL (*Rec. Méd. Vét., 96 (1920), No. 4–6, pp. 94–109, figs. 4; abs. in Jour. Compar. Path. and Ther., 33 (1920), No. 2, pp. 128–132; Trop. Vet. Bul., 8 (1920), No. 2, pp. 153, 154*).—This is a report of studies made of material from 80 individual bovines.

The value of the intrapalpebral mallein test in the diagnosis of glanders, E. H. MASON and R. V. B. EMMONS (*Jour. Immunol., 5 (1920), No. 5, pp. 489–497*).—A study of the relative values of the intrapalpebral mallein test and the complement fixation and agglutination tests for the diagnosis of glanders is reported. The two serological reactions were conducted on the sera of 94 horses which had given slight but not definitely diagnostic intrapalpebral mallein reactions, and on 51 horses all of which gave negative intrapalpebral mallein reactions.

Of the 94 horses giving suspicious mallein reactions 71 gave positive complement fixation and 54 positive agglutination reactions. Taking the two reactions in conjunction, both reactions were positive in 38 cases and both negative in 15 cases. Of the 51 controls 3 gave a one+ and 2 a ± complement fixation reaction, while negative agglutination reactions were given in all cases. The authors conclude that the complement fixation reaction is of the greatest benefit in confirming a doubtful intrapalpebral mallein test, but that this reaction should be considered in connection with an agglutination test, one to act as a check upon the other.

The tuberculoses of animals, H. VALLÉE and L. PANISSET (*Les Tuberculoses Animales. Paris: Octave Doin & Son, 1920, pp. III+[5]+528, pls. 8; rev. in Jour. Compar. Path. and Ther., 33 (1920), No. 2, pp. 115–117*).—The several chapters of this handbook deal with the history of tuberculosis; the species affected and its incidence among domesticated animals in different European countries; symptoms; morbid anatomy; bacteriology; variability of tubercle bacilli; their resistance; diagnosis; etiology; immunization; prophylaxis of tuberculous animals, choice and application of sanitary measures; sanitary police; meats from tuberculous animals; milk from tuberculous animals, viru-

lence and danger to man, and transmission of tuberculosis through milk; and tuberculous animals with a variable temperature. A classified bibliography (pp. 428–482), an index of authors, and an index to the subject matter are included.

The influence of creosote, guaiacol, and related substances on the tubercle bacillus and on experimental tuberculosis.—Studies on the biochemistry and chemotherapy of tuberculosis, XIX, L. M. DeWitt, B. Suyenaga, and H. G. Wells (*Jour. Infect. Diseases, 27 (1920), No. 2, pp. 115–135*).—An extensive review of the literature on the efficacy of creosote and guaiacol preparations in tuberculosis therapy is given, indicating that "opinions as to their value or action, whether favorable or unfavorable, rest upon very slender evidence."

The experimental work reported, which was undertaken to throw further light upon the bacteriostatic and bactericidal action of the various members of the guaiacol series, consisted of tests of the bacteriostatic action on virulent tubercle bacilli of artificial media containing varying concentrations of cresol derivatives, of the bactericidal action as determined by exposing clumps of tubercle bacilli on agar to solutions of these antiseptics, and by the so-called garnet test and inoculation of guinea pigs. Therapeutic tests were also made with guinea pigs artificially inoculated with tubercle bacilli.

Results obtained show that substances of the creosote series, while having considerable bactericidal action toward the tubercle bacillus, do not possess a high bactericidal power either in vitro or in vivo. Creosote, guaiacol, and the cresols were found to have about the same bactericidal power as that reported for phenol by DeWitt and Sherman (E. S. R., 33, p. 482). The dihydroxy phenols, resorcin, hydroquinone, and pyrocatechin, were less active, and thymol slightly more active than phenol.

"The failure to observe any beneficial therapeutic effect on tuberculous guinea pigs is, in view of the low bactericidal power of the substances tested, to be expected. It does not mean, however, that these substances may not have value in open tuberculous infections in man in which other bacteria than *B. tuberculosis* are involved. But it does substantiate the opinion that seems to have been generally reached by careful clinical observers, that creosote and guaiacol do not have a specific action on tuberculous infection."

The complement fixation reaction in tuberculosis, W. W. Watkins and C. N. Boynton (*Jour. Amer. Med. Assoc., 75 (1920), No. 14, pp. 933–937*).—This is a statistical report of results obtained in 6,500 complement fixation reactions for tuberculosis, together with a discussion concerning the relative value of different antigens, the specificity of the reaction, and the clinical value of the results.

The authors are of the opinion that there is little to influence a choice of antigens provided the whole bacillus is used and thoroughly broken up. They consider the reaction to be specific for tuberculosis, a positive reaction indicating active or recently active tuberculosis, and a negative reaction either absence of infection, excessive activity of the disease exhausting the antibody, or arrest of the disease with spontaneous disappearance of antibody no longer required.

The virulence of tubercle bacilli isolated from bovine lesions in India, A. L. Sheather (*Jour. Compar. Path. and Ther., 33 (1920), No. 2, pp. 73–103*).—Experiments by the author, who is director and first bacteriologist of the Imperial Bacteriological Laboratory, Muktesar, India, do not fully confirm the conclusions of Liston and Soparkar (E. S. R., 38, p. 285) that Indian cattle are less susceptible to infection with the tubercle bacillus than English animals when tested with a virus of European origin. "The experiments here recorded

indicate that this is not the sole, and possibly not even the most important, factor in determining the comparatively infrequent occurrence of tuberculosis in Indian cattle. They appear to show beyond all possibility of doubt that the strains of tubercle bacilli infecting cattle in India possesses a distinctly lower degree of virulence than tubercle bacilli isolated from cattle in Europe."

The contagious or epizootic keratitis of bovines, A. DAILLE (*Rev. Vét. [Toulouse], 72 (1920), No. 1, pp. 1-10*).—The author reports having observed many cases of this affection in cattle imported into France from the United States. It is characterized by an acute corneal inflammation with a tendency to ulceration. The average incubation period is from three to six days, and perhaps longer. It is often serious, since it may lead to blindness or corneal blemishes. In affected animals observed by the author, blindness occurred in not more than 4 per cent. Good results are said to have been obtained by irrigating the eye with sodium borate or with oxycyanid of mercury, or in alternation of a 1 per cent solution of methylene blue with cocainized astringent collyria.

State serum plant (*Kansas Sta. Rpt. 1919, pp. 70, 71*).—A brief description is given of the production, standardization, and distribution of antihog cholera serum at the State serum plant.

On the etiology of enzootic meningo-encephalitis (Borna disease) of equines, R. KRAUS, L. KANTOR, and R. QUIROGA (*Rev. Inst. Bact. [Argentina], 2 (1919), No. 3, pp. 239-260, pls. 33*).—The authors report having cultivated a well characterized diplococcus from lesions of the brain of horses affected with enzootic meningo-encephalitis, with which they were able to reproduce the disease in rabbits and horses. The histological lesions described by Joest and Degen (E. S. R., 26, p. 786), consisting principally of an infiltration of the cerebral vessels, were found present in the brains of sick and dead horses. The disease is said to have been observed during the summer in Argentina for several years past.

The Kansas horse disease in the Arkansas Valley of Colorado, O. B. MORGAN (*North Amer. Vet., 1 (1920), No. 2, pp. 67-71, figs. 5; also in Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 6, pp. 712-717*).—This is a report upon the outbreak of this disease which occurred in the Arkansas Valley of Colorado in July, 1919. Of the cases treated by the author, 61.2 per cent recovered.

Gastrophilus larvæ and equine infectious anemia, P. J. DU TOIT (*Monatsh. Prakt. Tierheilk., 30 (1919), No. 3-4, pp. 97-118; abs. in Trop. Vet. Bul., 8 (1920), No. 2, pp. 147, 148*).—A horse injected with the watery extract of Gastrophilus larvæ gave a typical reaction which the author regards as toxic in nature and not anaphylactic. The severity of the reaction was found to depend upon the size of the dose. The potent portion of the extract passes through a Berkefeld filter. A watery extract obtained from tapeworms of the dog produced a similar reaction. Fatal results can be produced by injection into a healthy horse of blood from a horse injected with bot extracts, but infectious anemia is not thereby transmitted. The experiments conducted have led the author to conclude that no relation exists between Gastrophilus larvæ and equine infectious anemia. A list is given of 32 references to the literature.

Bacterium viscosum equi causing disease in foals, V. ADSERSEN (*Maanedsskr. Dyrlæger, 31 (1919), No. 7-8, pp. 145-161; abs. in Jour. Compar. Path. and Ther., 33 (1920), No. 2, p. 122*).—On examining 135 dead foals the author found 36 suffering from a specific infectious disease which he has named bacillary pyo-septicemia. This disease is followed by death in the course of the first few days after birth. The autopsy always reveals embolic nephritis, and

also as a rule polyarthritis; sometimes embolic nodules are present in the lungs. Pure cultures of a specific oval bacillus, which is Gram-negative and especially characterized by its slime production, were isolated from the infected organs. The disease has since been found in Sweden by Magnusson, who has proposed the name *Bacterium viscosum equi* for the microbe in question (E. S. R., 39, p. 686).

This organism is also the cause of disease in older foals. Three cases are described in which foals aged 3 to 4, 4 to 5, and 15 months, respectively, died from a disease of short duration. A post-mortem examination established embolic nephritis and verminous thrombosis of the mesenteric vessels, and in the thrombi were found numerous small pus centers from which, as well as from the embolic lesions in the kidneys, *B. viscosum equi* was isolated.

Relation between adequacy of diet and immunity to roup (*Kansas Sta. Rpt. 1919, pp. 73, 74*).—A brief report is given of a six months' test under laboratory conditions to determine whether feeds lacking in fat-soluble vitamin will predispose chickens to roup. Eight pens, each consisting of 6 females and 1 male, were fed on different known rations, and at the end of each 4-week period 2 of the birds in each pen were inoculated with the natural virus from a typical case of ocular roup by sewing a string saturated with the virus through the eyelids of the birds.

The total number of cases of roup from the inoculated birds in each pen was as follows: Seven in birds on a ration of pearl hominy 70, corn bran 7, rice polishings 5, lard 5, ash mixture 3, and wheat gluten 10 per cent; 3 in birds on the same ration except that butter replaced the lard; 8 on the same ration as the first except that the pearl hominy was reduced to 60 per cent and 10 per cent by weight of oats included; 7 on the last ration with the exception that the oats were sprouted; 3 on corn; 5 on 90 per cent corn and 10 per cent alfalfa; 7 on kafir; and 4 on 90 per cent kafir and 10 per cent alfalfa. The greater susceptibility in the first group as compared with the second is attributed to the inadequacy of the first ration in the fat-soluble vitamin.

Parasitological investigations (*Kansas Sta. Rpt. 1919, pp. 48, 49*).—Brief reference is made to studies of the chicken tapeworms *Davainea oesticillus* and *D. tetragona* Molin, accounts of which by Ackert have been noted (E. S. R., 41, p. 881) and of the fowl nematode *Heterakis perspicillum*. Examinations of 424 fowls showed an infestation by *H. perspicillum* of 42.4 per cent, an average number for each infested chicken of 10.6 worms. While the number of deaths of mature fowls caused by this nematode is not small, a definite report can not as yet be made. It has been determined that "(1) a mature female worm may contain about 1,500 fertilized eggs at one time; (2) the eggs do not begin to develop until they leave the body of the worm; (3) embryos in eggs can resist at least seven days of desiccation [and] resume development when moisture is added; (4) both fertilized and segmenting eggs (two-celled stage) are resistant to continuous freezing at 11 to 18° F. for 15 hours, but neither can endure 22 hours of such freezing; (5) unsegmented fertile eggs fail to develop in the digestive tracts of chickens, while eggs containing curved, motile embryos hatch in the small intestine and are half grown in a month."

Lice, mites, and cleanliness, J. W. KINGHORNE and D. M. GREEN (*U. S. Dept. Agr., Farmers' Bul. 1110 (1920), pp. 10, fig. 1*).—This is a popular summary of information intended for the beginner, and especially for members of the Boys' and Girls' Poultry Clubs.

RURAL ENGINEERING.

Rice irrigation measurements and experiments in Sacramento Valley, 1914–1919, F. Adams (*California Sta. Bul. 325 (1920), pp. 69, figs. 4*).—This bulletin supplements a previous bulletin by Robertson (E. S. R., 37, p. 483) and summarizes and discusses the results previously reported, together with the results of later water measurements and rice irrigation experiments. The work was done under a cooperative agreement between the U. S. Department of Agriculture, the California State Department of Engineering, and the State Water Commission.

A total of 43 full-season field observations on the use of water on rice were completed during the years 1916, 1917, and 1918. The average net depth of water applied to 22,404 acres during these observations was 4.89 ft. Of this area 21,419 acres were clay or clay adobe. A 4-year record of use of water on 39.5 acres of Stockton clay adobe, well prepared and irrigated, showed a range in depth of water applied of from 4.27 to 4.87 ft. with an average of 4.53 ft. An annual depth of 5 ft. of irrigation water for rice was found to be sufficient for the principal rice soils of the Sacramento Valley, including the clays and clay adobes of the Willows, Stockton, Sacramento, Capay, and Yolo series. Pervious loam soils were found to require an excessive amount of water, and for this reason are considered to be unsuitable for rice growing.

The use on individual fields of 1 cu. ft. per second of irrigation water to from 30 to 40 acres during the first flooding after seeding is not considered excessive. The seasonal use on this basis averages about 1 cu. ft. per second for each 65 acres. About one-third of the water applied to rice fields was lost by evaporation from the surface of the standing water during submergence. As in the previous experiments, it was found that maximum rice yields were obtained from submerging the fields 6 in. deep, beginning 30 days after emergence of the plants above ground, except on alkali soils where the submergence was best begun 15 days after emergence.

Constant movement of the irrigation water through the rice checks during the period of submergence was necessary only where the soil contained alkali in sufficient quantities to affect the plants. Keeping the rice field only moist or muddy throughout the growing season gave reduced yields of poor quality. The experiments so far have not fully demonstrated that fluctuating the depth of submergence is beneficial.

"It is imperative that ground water and rise of alkali be controlled in California rice fields, both by confining rice growing to the heavier, impervious clays and clay adobes and by thorough and adequate drainage facilities embracing the entire areas affected or likely to be affected. A prime factor in control of water grass in rice fields is the keeping of banks of canals and ditches, principally lateral and field ditches, entirely free of this pest."

Data on the gross duty of water on rice obtained from private sources are appended.

The western farmer's water right, R. P. Teele (*U. S. Dept. Agr. Bul. 913 (1920), pp. 14*).—A description is given of those features of water rights with which every person who is engaged in irrigated agriculture should be familiar. Much of the discussion is taken from the author's book, Irrigation in the United States (E. S. R., 34, p. 784), and A Treatise on the Law of Irrigation and Water Rights, by Kinney (E. S. R., 31, p. 586).

Surface water supply of lower Columbia River and Pacific slope drainage basins in Oregon, 1917 (*U. S. Geol. Survey, Water-Supply Paper 464 (1920), pp. 149+LI, pls. 2*).—This report, prepared in cooperation with the

States of Oregon and Washington, presents the results of measurements of flow made on the Columbia River at The Dalles, Oreg., on tributaries of the Columbia River below the mouth of the Snake River, and on streams between the Columbia and Klamath Rivers during the year ended September 30, 1917.

Surface water supply of South Atlantic slope and eastern Gulf of Mexico drainage basins, 1918 (*U. S. Geol. Survey, Water-Supply Paper 472 (1920), pp. 56+XXIX, pls. 2*).—This report presents the results of measurements of flow made on nine river basins in this area during the year ended September 30, 1918.

Surface water supply of St. Lawrence River Basin, 1918 (*U. S. Geol. Survey, Water-Supply Paper 474 (1920), pp. 110+XXXII, pls. 2*).—This report, prepared in cooperation with the States of Wisconsin, New York, and Vermont, presents the results of measurements of flow made on streams tributary to each of the Great Lakes and to the St. Lawrence River during the year ended September 30, 1918.

Routes to desert watering places in the Salton Sea region, Calif., J. S. Brown (*U. S. Geol. Survey, Water-Supply Paper 490-A (1920), pp. 86, pls. 7, figs. 2*).—This is the first of four abbreviated guides, published in advance of the complete reports, consisting essentially of maps, road logs, and very brief descriptions of the watering places. This introductory number contains a preface by O. E. Meinzer. It covers a region of about 10,000 square miles occupying the southeast corner of California, and was prepared in cooperation with the State Department of Engineering.

Charts for solution of Manning's hydraulic formula, E. G. Harris (*Engin. News-Rec., 85 (1920), No. 18, pp. 837-839, figs. 2*).—Two charts of data for the solution of Manning's formula for the flow of water in rectangualr and trapezoidal channels and circular and egg-shaped conduits are given, together with solutions of practical problems.

Defects in current meters and a new design, S. Fortier and E. J. Hoff (*Engin. News-Rec., 85 (1920), No. 20, pp. 923, 924, figs. 2*).—In a contribution from the Bureau of Public Roads of the U. S. Department of Agriculture, attention is drawn to some of the defects of current meters in present use, and the requirements of a meter suitable for irrigation and drainage ditches are outlined. It is pointed out that large bulky meters indicate faulty design, more particularly for the smaller channels, owing to the obstruction which they present and to the impracticability of measuring bottom currents and inaccuracies introduced in measuring top currents. In the design of a new meter the propeller type was selected owing to the fact that such a meter is acted upon only by the axial components of the downstream currents.

Studies of the starting velocities of meters in present use showed that some of them move under minimum velocities of about 0.2 ft. per second, but that the motion is erratic up to velocities of from 1.5 to 3 ft. per second.

On the basis of these requirements and extensive tests, a new meter was devised, which is illustrated. It is a propeller type with the axis of support directly above the propeller, thus eliminating errors caused by deviation of the horizontal axis. Instrumental friction is reduced to a minimum by the use of a material having a specific gravity equal to that of water. The simplicity of design is considered to maintain a high operating efficiency and lessen cost.

A stilling rack for weirs, G. S. Binckley (*Engin. News-Rec., 85 (1920), No. 12, p. 558, fig. 1*).—A stilling device is described and illustrated, consisting of three series of vertical strips of wood placed with spaces between the strips of about one-third their width or less and the series separated from each other by horizontal strips at top and bottom only, forming a unit which fills the

cross section of the weir box. The vertical strips in the middle series are so placed as to come opposite the openings on each side, thus deflecting the water in its flow through the rack.

Cast-iron and wood-stave pipe economically compared, J. W. Ledoux (*Engin. News-Rec., 85 (1920), No. 20, p. 932*).—Comparative data on cast-iron and wood-stave pipe are briefly presented, showing that wood-stave pipe has a short life and generally a material leakage, but that it is low in cost and has a high coefficient of discharge, and consequently small frictional resistance to flowing water. Cast-iron pipe is high in cost and after a few years' use has a low coefficient of discharge and a high frictional resistance to flowing water. It possesses a long life and can be easily repaired in case of leakage which is usually negligible. On account of the cheapness of wood-stave pipe, a material amount of leakage is permissible from an economic standpoint.

Irrigation pumping plants, G. S. Knapp (*Kans. Bd. Agr. Quart. Rpt., 39 (1920), No. 154, pp. 32, figs. 10*).—General information on the selection, installation, and cost of pumping machinery for irrigation pumping plants is given. A typical plan of each of five of the most commonly used types of plants is shown, togethed with a picture of a completed plant and a detailed description of the plant and the conditions for which it is particularly suited.

Experimental sewage irrigation plant in Florida, F. E. Staebner (*Engin. News-Rec., 85 (1920), No. 18, pp. 848, 849, figs. 3*).—An experimental sewage irrigation plant built by the Florida Experiment Station and the U. S. Department of Agriculture, cooperating, is described. This plant consists of a septic tank, broken stone filter bed, diversion box, collecting tank, pumping plant, eight automatically operated discharge valves, and a ditch distribution system. The filter effluent is pumped to the field, and the discharge of the risers on the pipe laterals is controlled by automatic float valves.

TNT as a land clearing explosive (*Wisconsin Sta. Bul. 319 (1920), pp. 38, 39*).—Studies by J. Swenehart of TNT as a blasting explosive showed that it requires a No. 8 cap for detonation, and it was not detonated by bullet shock from a high-power rifle.

It was found to be resistant to such moisture as occurs under ordinary conditions of land clearing and was successfully detonated after storage at 39° F. It gave satisfactory results on stump, rock, and ditch blasting as compared with 20 per cent dynamite.

Sensitiveness tests showed that detonation did not occur where portions of TNT were within 6 in. of each other. [Reports from other sources would indicate that this can not be generally accepted with safety.]

Modern road construction, F. Wood (*London: Charles Griffin & Co., Ltd., 1920, 2. ed., rev. and enl., pp. XII+284, pls. 11, figs. 59*).—This is the second revised edition of this practical treatise on road construction for the use of highway engineers, students, and local authorities (E. S. R., 28, p. 882). It contains chapters on macadam roads, wear of roads, effect of traffic on roads, foundations, tar, bitumen, methods of using tar and bitumen, rollers and rolling, paving, and cost of maintenance of roads. Specifications and data on materials of construction are appended.

Roads and loads, R. C. Barnett (*New York: Natl. Auto. Chamber Com., Inc., Motor Truck Com., 1920, pp. [15], figs. 10*).—An analysis of factors determining the load which a motor truck will haul on different grades and over various kinds of road surfaces is presented, based on empirical and other data derived from experimental work by the author and others.

In the analysis of tractive effort, preliminary experiments were conducted to determine the coefficient of friction of rubber tires on different kinds of

pavement. The apparatus used consisted of a sled having its runners shod with pieces of old rubber tires and a spring balance for measuring the horizontal force necessary to pull the sled along the pavement. The horizontal force was divided by the weight on the runners to give the desired coefficients. The following coefficients of friction were obtained: Dusty water-bound macadam 0.53, gritty water-bound macadam 0.545, dry-packed cinders 0.56, moist sand 0.64, dry dirt 0.51, dry oiled macadam 0.79, dry bituminous macadam 0.87, wet bituminous macadam 0.74, dry concrete 0.925, wet concrete 0.82, and dry monolithic brick 0.77. It is shown that tractive effort is dependent upon and limited by the friction between tires and pavement, is dependent upon the amount of torque that can be delivered to the drivers, and bears a definite relation to the speed of the truck and the horsepower of the engine.

Data from different sources is also given on the tractive resistance of different pavements, and the final formula for total resistance to motion on different grades derived. From this the following general formula for permissible truck load is derived:

$$W=\frac{1}{\left(\frac{t\cos\alpha}{2{,}000}+\sin\alpha\right)}\left(\frac{375\,\mathrm{BHP}f}{M}-.005M^2A\right)$$

in which W is the total load in pounds, t is the unit of tractive resistance, α is the angle of the grade, BHP is the brake-horsepower of the engine, f is the transmission efficiency factor, M is the speed in miles per hour, and A is the area of exposed surfaces normal to motion in square feet. Graphic data covering a wide application of the above are included.

Trend of highway development: A survey (*Engin. News-Rec., 85 (1920), No. 20, pp. 920–922*).—This is the first of a series of reports on the highway situation in the United States and deals with the States of Wisconsin and Michigan.

The outstanding features of the practice in Wisconsin are the use of one-season contracts, construction by force account, utilization of local material, and the extent of maintenance work. The practice in Michigan is notable for the use of gravel for trunk-line construction, the conservative character of the hard-surfacing program, and the intensive service secured from surplus war materials.

Study of temperature stresses in rigid pavement slabs, C. H. Scholer (*Engin. News-Rec., 85 (1920), No. 20, pp. 943, 944, figs. 3*).—The methods and apparatus used by the Kansas Engineering Experiment Station in the study of temperature stresses in rigid pavements are described. The apparatus consists of a 20-in. Berry strain gauge with an Ames dial, which will permit the measurement of a change between gauge points of 0.0001 in.

Utility of hardwoods for paving shown in comparative tests, E. E. Butterfield (*Engin. News-Rec., 85 (1920), No. 14, pp. 656–658*).—Tests of different hardwoods to determine their utility for paving are reported, indicating that the greater strength and relative unsusceptibility to expansion from water absorption of the dense hardwoods, such as white oak, chestnut oak, and hickory, seem to merit a more extended trial for paving purposes.

Inclined-bearing tests on Douglas fir and white pine, T. R. Simpson (*Engin. News-Rec., 85 (1920), No. 14, pp. 654, 655, figs. 4*).—A series of tests, conducted at the University of California, on the bearing strength of Douglas fir and California white pine, when the bearing surface was inclined to the grain, is reported.

It was found that there was a close check with the Jacoby formula when the elastic-limit load was taken as the criterion of permissible value, and an approximate agreement with the Howe formula when a fixed depth of indentation was taken as the criterion. It is concluded that the Jacoby formula appears to express the proper relation between load and angle of grain and should be used. It is as follows:

$$n=p\sin^2\theta+q\cos^2\theta$$

in which p=allowable intensity of stress in end bearing, q=allowable intensity of stress in cross bearing, and n=allowable intensity of stress on a surface inclined at an angle θ with the grain.

Crushing strength of southern pine at angles to grain, Q. C. AYRES (*Engin. News-Rec., 85 (1920), No. 14, pp. 653, 654, figs. 2*).—Tests at the University of Mississippi of the compressive strength of southern yellow pine on surfaces at angles of 0, 15, 30, 45, 60, 75, and 90° to the grain are reported.

It was found that the specimens tested parallel to the grain failed by sliding along a plane oblique to the grain, while all other specimens failed by shear along a plane parallel to the fibers. There was a fair agreement between the test values and those computed from the Howe formula. This formula gives values which err on the side of safety, and is considered the best and simplest expression for use in dealing with southern pine. It is as follows:

$$n=q+(p-q)\left(\frac{\theta^\circ}{90^\circ}\right)^{5/2}$$

in which p, q, and θ are used as in the preceding abstract.

Manual of design and installation of Forest Service water spray dry kiln, L. V. TEESDALE (*U. S. Dept. Agr. Bul. 894 (1920), pp. 47, pl. 1, figs. 13*).—This bulletin describes the water-spray dry kiln for the artificial seasoning of lumber, as designed and developed by the Forest Service, and gives considerable data on design and materials and details of construction. The main feature of the present design is the principle of forced circulation and humidity control by means of sprays of water. This kiln is considered to be adapted to commercial use in the kiln-drying of refractory hardwoods of large dimensions and green lumber of all kinds.

Concrete in alkali soils and waters, A. S. DAWSON (*Jour. Engin. Inst. Canada, 3 (1920), No. 10, pp. 476–480*).—A progress report on the subject is presented, in which a discussion of the origin of alkali salts and their action on concrete is followed by the results of laboratory and field tests of concrete cylinders made from two different cements.

The results to date show that laboratory test cylinders are all relatively lower in strength than field test specimens because of the difficulty in maintaining a uniform degree of moisture. The most disintegration of specimens was found at locations of greatest concentrations of soil solutions.

In a concrete of high density the action appeared to be relatively slow and was largely in the nature of surface action, gradually extending to the interior. In relatively porous concrete the action was more rapid and apparently took place simultaneously throughout the structure. The more porous concrete was also found to be subject to the action of other disintegrating forces of a physical nature, such as frost and the crystallization of salts in the pore spaces. A dense concrete mixture resulted in greater resistance to alkali action, this being true for both 1 : 1½ : 3 and 1 : 2 : 4 mixtures. The presence of alkali soil solutions did not retard the setting of the cement, and no difference was apparent between the different cements used.

The experiments are being continued.

Results of tractor tests made at Ottawa Beach, [Mich.], F. V. HERDMAN (*Agrimotor, 3 (1920), No. 11, pp. 13–15, figs. 7*).—Tests of a speed plow with with two 14-in. bottoms and of 2 and 3-bottom plows of ordinary type to determine the relation of speed to drawbar pull, labor cost per acre, drawbar horsepower, and horsepower per acre are reported. Speeds up to slightly over six miles per hour were used. The soils were, as a whole, dry sand with loose sod on top.

With the speed plow it was found that the drawbar pull was 945 lbs. at 1.7 miles per hour, 1,208 lbs. at 2.6 miles per hour, 1,000 lbs. at 3.3 miles per hour, 1,240 lbs. at 4.37 miles per hour, and 1,320 lbs. at 5.65 miles per hour. Considering the first and last values, the increase in drawbar pull per mile increase in speed was 95 lbs. The drawbar horsepower increased quite uniformly from 4.28 at 1.7 miles per hour to 19.89 at 5.65 miles per hour, or an average increase of 3.96 h. p. per mile increase in speed. The horsepower requirement per acre varied closely with the drawbar pull, showing the same decrease at 3.3 miles per hour and then uniformly increasing. The labor cost per acre decreased considerably as the speed increased, this decrease being uniform.

With the two 14-in. bottoms plow the drawbar pull was 730 lbs. at 2.54 miles per hour, 830 lbs. at 4.51 miles per hour, and 1,010 lbs. at 6.02 miles per hour. There was no intermediate decrease as in the case of the speed plow. The drawbar horsepower increased rapidly with speed increase from 4.94 at 2.54 miles per hour to 16.21 at 6.02 miles per hour. As with the speed plow, the drawbar horsepower per acre corresponded closely with the drawbar pull, and the labor cost per acre decreased rapidly with increase in speed, averaging 13.8 cts. per mile increase in speed.

With the three 14-in. bottoms plow the drawbar pull increased rapidly up to a speed of 2.4 miles per hour and not so rapidly to 3.26 miles per hour. From 3.26 to 4.83 miles per hour there was a distinct decrease in drawbar pull. The drawbar horsepower increased rather uniformly with speed increase. The drawbar horsepower per acre varied somewhat the same as the drawbar pull, increasing up to a certain speed and then decreasing with additional increase in speed. The labor cost per acre decreased gradually with speed increase.

Considerable graphic data of the tests are presented showing different correlations. Additional tests of the 2-bottom plow are also reported showing some variation in results. No conclusions are drawn.

The Royal Agricultural Society's 1920 tractor trials (*Impl. and Mach. Rev., 46 (1920), No. 546, pp. 891–898, 898A, 898B, figs. 2*).—The results of competitive tests of 38 different tractor plowing outfits on heavy clay soil in England are reported and discussed. The tests comprised mainly a comparison of different types, and no conclusions with an engineering bearing are presented.

How to get results from grinding wheels, G. H. RADEBAUGH (*Power Farming, 29 (1920), No. 10, pp. 16, 17, 22, 24, figs. 17*).—Information is given on the selection, installation, and use of grinding wheels, including tabular data on grinding-wheel and spindle sizes and grinding-wheel speeds.

Better belt lacing, E. W. GAGE (*Amer. Thresherman and Farm Power, 23 (1920), No. 6, p. 9, figs. 7*).—Data and diagrammatic illustrations on proper belt lacing are given.

Stairways of rural habitations, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 33 (1920), No. 15, pp. 257–260, figs. 7*).—Data are given on the design of stairways for farmhouses in accordance with French practice.

RURAL ECONOMICS AND SOCIOLOGY.

Studies in the economics of agriculture (*Kansas Sta. Rpt. 1919, pp. 10–14*).—This section of the report covers investigational work at the station during the fiscal year 1918–19.

Data reported from 2,533 farm owners returning answers to a questionnaire sent out early in 1919 are briefly summarized, and indicate that land ownership in Kansas gained by purchase was 68.8 per cent; by homestead 12.2 per cent; by inheritance 6.9 per cent; by gift 3.3 per cent; by marriage 1.9 per cent; and by other methods (chiefly trading) 0.7 per cent. The number not reporting on this point amounted to 6.2 per cent.

The principal tendencies brought out are that the age at which men become farm owners in Kansas has steadily increased from 24.6 years in 1875–1880 to 34.7 years in 1915–1919, that the period of years which young men have spent as tenants has increased from 4.1 years in 1875 and before to 9.4 years in the period 1915–1919, and that the period of years which young men have spent as hired farm laborers has increased from 4.2 years in 1875 and before to only 5.5 years in 1915–1919.

There are also reported a farm labor survey of 201 farms in Jackson County obtaining records of the farm business for the season of 1917 and an enterprise survey of 300 farms in 12 counties to determine the cost of producing the 1918 wheat crop. From the first it was determined that the average labor income for the 201 farms was $1,556 as compared with an average of $406 for the same farms in 1916, this increase being due to crop yields that were nearly doubled and to the increase in price of farm products. From the second study noted, it was determined that where the average 1918 yield of wheat was greater than the 10-year average yield, the cost per bushel was less than $2, but where it was less than this average the cost per bushel was more than $2.

Figures obtained from 60 farms in Harvey County, Kans., having an average yield per acre of 18 bu. show the average cost per bushel to have been $1.47 in 1918, the average cost per acre $26.50, the average area of wheat per farm 105.2 acres, the average number of bushels per farm 1,894, the average value of wheat per farm at $2 a bushel therefore being $3,788, and the average cost per farm $2,784, showing the average profit from wheat per farm to be $1,004.

Farm business in Quebec, J. A. Ste. Marie (*Canada Expt. Farms Bul. 96 (1920), pp. 16, figs. 3*).—A preliminary survey was conducted on 25 farms in one representative district in each of six counties in the Province and the information entered in special forms. Analysis of the data shows that the labor income varied indifferently with the various size groups, owing to the different systems of farming followed and to the higher value placed on real estate in one district particularly than in others.

A study was made of farm business by districts, in only two of which was there being made an average plus labor income. Good management, as expressed by high receipts per animal unit yielding high gross returns on the capitalization, accounted for success rather than the size of farm and capitalization. Districts or groups where the live-stock index was below 100 were found not to yield a plus labor income. An average cost of operation amounting to 13 per cent of the total capital was found. Dairy farming plus a cash crop, mainly fruits, grass and clover seed, potatoes, maple sugar, tobacco, or vegetables, is said to be the system that brings most satisfactory results when compared with general dairy farming and dairy farming for city trade. The returns of the cows vary with the quality of sire used, and the scrub sire is said to be responsible for an annual loss to the Province of Quebec of over $11,347,680.

The Government exhibit at the 1920 National Dairy Show (*U. S. Dept. Agr., Dept. Circ. 139 (1920), pp. 17, figs. 4*).—This is a description and prospectus of the Dairy Division's exhibit at this show. The material shown illustrated the various activities of a somewhat unusual dairy community, that of Grove City, Pa. (E. S. R., 41, p. 677).

Farm management and farm bookkeeping, R. Zeeb (In *Handbuch der Landwirtschaft. Stuttgart: Eugen Ulmer, [1919], pp. 606–679, figs. 2*).—In the first of these two chapters of this handbook certain fundamental principles of farm management are briefly stated, together with reference material and examples on the subject. Crop rotations and field systems, scales of land values as dependent upon yields and location, investment of capital in buildings and live stock, and the cost and management of farm labor are included in the discussion. The second chapter is given to a discussion, with examples, of simple bookkeeping systems particularly adapted to medium or small farming enterprises.

Credit needs of settlers in upper Wisconsin, R. T. Ely, B. H. Hibbard, and A. B. Cox (*Wisconsin Sta. Bul. 318 (1920), pp. 35, figs. 5*).—A settler in this region is said to require from $1,000 to $1,500 in capital or in capital and credit through the pioneering stage and about $2,500 through the development stage, covering the erection of permanent buildings, accumulation of farm machinery, and the breeding of a good diary herd.

Settlers need credit of two types, long-term credit for the purpose of paying land debts and making improvements, and short-term credit for financing farm crop operations. A third more or less intermediate type is said to be required for the purpose of purchasing live stock and machinery.

The agencies at present providing or capable of providing rural credit under State provisions to the man with some resources are the State banks, land mortgage associations, and cooperative credit associations, although none of the latter has as yet been organized. The first credit generally comes from the land and colonization companies. It is considered that the latter under an efficient program of licensing regulation, such as the State has started upon, might well be encouraged as the medium of advising and providing credit, marketing, and social assistance to settlers, especially those with little money.

How California is helping people own farms and rural homes, E. Mead (*California Sta. Circ. 221 (1920), pp. 28, figs. 8*).—A brief outline is given of some of the reasons for the adoption in California of a State policy of aid in land settlement, and details of the purchase of two tracts of land as settlement projects, terms of payment by settlers, capital required, and the progress of settlement on them are set forth. It is suggested that a separate board is needed to provide care and training for those incapacitated ex-service men desiring to become settlers on State lands.

Legal provisions founding soldiers' homesteads in Germany (*Internatl. Inst. Agr. [Rome], Internatl. Rev. Agr. Econ., 11 (1920), No. 1, pp. 54–59; also in Inform. Agr. [Madrid], 10 (1920), No. 224, pp. 365–369*).—Portions of two laws, one providing capital by a grant in lieu of a pension and the other an order for procuring agricultural land for settlement, are briefly described, as well as a homesteads law and a settlement law promulgated in the Duchy of Brunswick, April 19, 1918.

The tenancy problem (*Wisconsin Sta. Bul. 319 (1920), p. 55*).—This note indicates some of the results of investigations by the agricultural economics department, not elsewhere noted. It has been found that out of each 1,000 agricultural workers in Wisconsin there were 94 more laborers and only 25 more tenants in 1910 than in 1880. Data collected by B. H. Hibbard and J. D.

Black are said to indicate that men who were tenants in southern Wisconsin in 1916 became tenants at an average of 29.2 years of age, but the men who were owners in 1916 had become owners at 32.9 years. Wisconsin was the only State in the Union which showed an increase between 1900–1910 in percentage of value of farms covered by mortgages.

An analysis of the business records for 1913, 1914, and 1915 of 265 owned farms, 148 share-rented farms, and 45 cash-rented showed $400 higher net farm incomes for the rented farms than for the owned farms.

The farm lease contract, L. C. GRAY and H. A. TURNER (*U. S. Dept. Agr., Farmers' Bul. 1164 (1920), pp. 36*).—Certain main classes of farm leases coming under the several types of farming, namely, cash, standing rent, share, share cash, and stock share are defined. Points to be considered in drawing up the farm lease are listed under the headings of general details; reservations; assurances and guaranties by the tenant; assurances and guaranties by the landlord; agreements with respect to credit furnished by the landlord; respective contributions by each party to operating capital; adjustments with respect to property owned in joint account; respective contributions by each party to expenses; payment of rent; privileges for which special rent is or is not to be paid; specifications with respect to the care, use, and improvement of real estate and arrangement for labor and materials used or needed for these purposes; specifications with respect to farming method and procedure; provision for supervision; procedure at termination of lease; enforcement of contract; and final details.

Discussion follows of problems common to all kinds of farm leases, whether cash or share, some special problems of share leases, fundamental principles underlying all these contracts, and the personal relationship.

Farm leasing systems in Wisconsin, B. H. HIBBARD and J. D. BLACK (*Wisconsin Sta. Research Bul. 47 (1920), pp. 60, figs. 3*).—Sample leases of important types prevailing in Wisconsin are exhibited, including a cash lease and a half-and-half dairy lease with analysis of provisions common to both and the general differences between cash and share leases. Other types described are the land-and-stock cash lease, the landlord's cattle dairy lease, the one-half-all-stock lease, the one-third stock lease, the one-third grain lease, the one-half grain lease, the share-cash lease, and the grain-and-dairy lease. Still another type of contract between landlords and tenants known as an "agreement to work land" is reproduced.

A comparison of cash and share renting, the latter mostly under the half-and-half dairy lease, on 193 farms in eight counties in Wisconsin, namely, Walworth, Green, Dane, Winnebago, Wood, Eau Claire, St. Croix, and Barron, in 1914, 1915, and 1916, indicates that share-rent farmers make their money by farming extensively, using machinery and keeping expenses down. Cash renting always predominates where farms are small or cheap and generally in truck farming districts near large cities. Women, speculators, and absentee landlords generally rent for cash or grain rent. Retired farmers, on the other hand, usually prefer to rent under land-and-stock share leases except in certain sections of the State. Cash rent may be as successful as share-rent farming, if landlords will put in proper restrictions, choose their tenants carefully, and give them proper supervision. According to the landlords' returns from two groups of farms, in number 1185 and 45, respectively, the data for which were obtained in the first instance from letters written in July, 1917, to landlords and tenants in all counties in the State and in the second from surveys of the farms made in cooperation with the U. S. Department of Agriculture in 1914, 1915, and 1916, in four counties, Dane, Walworth, Barron, and St. Croix,

it seems that farms actually pay 2.5 per cent figured on the basis of the market value of the farm or higher than that on the basis of the original investment. A number of reasons are given why landlords' returns are low. Cash rents per acre in eight sections of the State in 1916–17, compared with the market value of rented land and rate of return upon the same, are found to be relatively high or low as interest rates are high or low, high where share renting predominates and low in a region of unusual active speculation, poor tenant farmers, frequent crop failures, and land overvalued with respect to production as may be the case near large cities.

In a series of six tables the farm business of a number of farms rented under various types of share leases used in Wisconsin is analyzed to indicate the division of income to landlord and tenant. The plans recommended for dividing expenses between landlord and tenant are to follow the custom so far as possible or to count the tenant's labor and management, family labor and hired labor, and interest, taxes, depreciation, and upkeep on his equipment, as equal to the landlord's management, interest, taxes, upkeep and depreciation on real estate and equipment, other expenses being divided half and half. Share tenancy is said to be an excellent apprenticeship in management and may well be included as one of the steps toward ownership.

A history of the English agricultural laborer, 1870–1920, F. E. Green (*London: P. S. King & Son, Ltd., 1920, pp. X+356*).—The periods into which the events of the long agitation among English agricultural laborers fall are here figuratively designated as "seed time for revolt, conditions prior to 1872; the upstanding crop, 1872; the farmer swings his scythe, the great lockout of 1874; the aftermath of thistles, the 'eighties; the winter of discontent; stirrings of new life, 1900; growth under stormy skies, 1910–14; and What of the harvest?"

The rise and fall of the National Agricultural Laborers' Union and other similar organizations, the creation of parish and rural district councils, and recent war-time investigation and regulation are set forth in detail.

The picture presented is one of depressing social and economic injustice to the farm laborer, especially in the matter of housing and wages, and opposition to his efforts at organization for higher wages and better hours. A bibliography of 115 references is given, and some tables showing cereal prices, cash wages and allowances for farm labor, food prices, and numbers of agricultural workers in Great Britain through several years are included in appendixes.

A history of the English agricultural laborer, W. Hasbach, trans. by R. Kenyon (*London: P. S. King & Son, Ltd., 1920, pp. XVI+465*).—This is one of a series of monographs by writers connected with the London School of Economics and Political Science, and is a reprint of a study previously noted (E. S. R., 20, p. 1091).

The contract piece wage in agriculture, Schneider (*Landw. Jahrb. Bayern, 9 (1919), No. 5, pp. 374–314*).—Many advantages of contract piecework over daywork are pointed out. A scale is given for the computation of a fair payment for pieceworkers in agriculture, worked out on the basis of the average accomplishment of the individual or groups of different types of agricultural laborers under varying conditions in several kinds of operations and in the cultivating and harvesting of several specific crops.

Hail insurance on farm crops in the United States, V. N. Valgren (*U. S. Dept. Agr. Bul. 912 (1920), pp. 32, figs. 6*).—The origin and development of three groups of business institutions writing hail insurance on growing crops in the United States, mutual hail insurance companies, which, with few exceptions, limit their business to the insurance of growing crops against hail; joint-

stock fire insurance companies, which write hail insurance on growing crops more or less as a side line; and State hail insurance boards or departments, under whose direction and control are administered State hail insurance funds, is briefly accounted for. It is noted that during 1918 these groups of hail organizations had in force insurance amounting to a total of about $318,543,000, on which the premiums amounted to $17,631,000, and that the figures for 1919, ascertained from correspondence and various reports, were approximately $559,134,000 and $30,330,000, respectively. Of the amount of hail risks in force in 1919, joint-stock companies had almost exactly one-half and the mutual and State hail insurance departments had one-fourth each.

The increase in volume of mutual hail insurance in the last decade is attributed to need on the part of farmers rather than to any general success on the part of organizations offering it. Record of a total of 121 such companies has been found, and of these only 41 were in existence at the time of the most recent insurance reports. This rate of ceasing to do business, however, is not higher than for joint-stock fire insurance companies. Early experiences with State hail insurance in North Dakota were discouraging, failure being due to inadequate premium charges provided by law and the condition that applications and premium advances had to be made in the spring before any crops were in existence.

Experiences of States other than North Dakota and their provisions by law, as well as the territorial distribution of the business, are described and illustrated. The three States of Kansas, North Dakota, and Iowa, in the order given, led all others in amount of risk in force.

Prevailing commercial rates charged by joint-stock insurance companies in 1919 are shown to have been highest in the region of Cheyenne and southward and in central Montana. Rates charged for various crops in typical sections of the United States are reported. An average expense of operation equal to about 35 per cent of the premium is noted, with some exceptions and variations.

It is recommended that a reasonable reserve is imperative under any plan of contribution or liability to it by the insured, this preferably equal in general to at least the average annual premium income.

Characteristics of the hail insurance contract are brought out by comparison with fire insurance contracts, and some special problems in hail insurance are discussed.

Fundamental principles of cooperation in agriculture, G. H. Powell (*California Sta. Circ. 222* (*1920*), *pp. 24*).—A cooperative association is defined as one in which the members form an agency through which they conduct their own business for the greatest mutual advantage. It may be organized as a nonprofit capital stock corporation or a nonprofit corporation without capital stock.

A farmers' association organized under the general stock corporation laws is deemed to be on an unstable foundation, because stock can not be controlled and conflicts arise between stockholders and members. Legislation covering such organizations is needed. Ways in which permanent capital and working capital are provided for are described. It is said that membership in successful farmers' cooperative associations should be confined to producers who use these facilities, and that definite membership agreements are effective, especially in meeting competition. Such an organization must originate from necessity. The management should be vested in a board of directors, and a competent manager elected by them should serve as the executive head of the organization. Best results are obtained in handling a special crop. A large cooperative movement formed of local units, but not controlling them, serves well as a

national advertising and sales agency, and is efficient in handling supply, grading, transportation, and legislative matters beyond the control of local producers' associations.

The point is made that the cost of distribution and the ultimate price to the consumer is of importance to the producer and reflects the success of this organization, also that the future of cooperation as a principle rests upon success in business methods and in meeting economic and social problems.

A rural social survey of Lone Tree Township, Clay County, Iowa, G. H. VAN TUNGELN and W. A. BRINDLEY (*Iowa Sta. Bul. 193 (1920), pp. 217–255, figs. 15*).—Each family in this township was interviewed, as were also the officers of various organizations and institutions. From the information gathered a brief history of the township and county was compiled, and an account of population and conjugal, economic, educational, political religious, and social and home conditions was drawn up.

In the matter of size and operation of farms, data here show 35.29 per cent of the farms in the township operated by owners and 64.71 per cent by tenants in 1916, the respective averages for the county in 1915 being 50.03 and 49.97 per cent and for the State 59 and 41 per cent. The average sizes of both farms operated by owners and by tenants were larger than those for the county and State.

A rapid increase is noted in land values and in the rate of tenancy. Three-fourths of the tenants who do not now own land stated that they expected to become landowners. A little over 45 per cent of the tenants belong to some farmers' organization, as compared with 50 per cent of the owner operators. The education of the farmers and their wives is on a par with that of the adults of the county and the State. A considerably larger percentage of the young people are enrolled in high school, college, and university than for the State. The farmers and farmers' wives have a good church membership showing, but the religious life of the community is at a low ebb considering its prosperity. Almost 18 per cent of the homes are completely modern and a higher percentage are partly so. The social life expresses itself most largely in connection with the public-school activities, the township band, and the German club. It is said that the older people of the community feel that there is a lack of recreation and social life for their young people, but they are at a loss to know how to provide for the need.

Agriculture and cattle breeding in the Netherlands and State measures furthering these branches of activity (*The Hague: Netherlands Min. Agr., Indus. and Com., 1915, pp. 210, pls. 2, figs. 96*).—This pamphlet is one of a general series published under the direction of the commercial department of the Netherlands Ministry of Agriculture, Industry, and Commerce at The Hague. It includes a description of the agriculture, cattle breeding, and dairying of the country; a discussion of State measures aiding agriculture; an account of the activities of farmers' and market gardeners' associations; and a brief note regarding the reclamation of waste lands.

Native agriculture in the French colonies, O. DENYS (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 4, pp. 3–115*).—The native cultivator is regarded as an essential factor in the prosperous development of the French colonial possessions, both from the utilitarian and humanitarian points of view. The advisability of a policy of encouragement is illustrated by the success of natives of the Gold Coast and of certain German colonies. A detailed account of the native agriculture of French west Africa, French equatorial Africa, Madagascar, and Indo-China is given, and recommendations are made for meeting local needs of conservation and protection of holdings, working credit, mutual insurance and loans, education, and trasportation.

Native agriculture in northern Africa, Jarry (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 4, pp. 330–340*).—This notes characteristics of the nomadic Arabs and of the Berbers who are dwellers in villages. The causes for the retarded development of the country, at one time prosperous and civilized, are said to be due to the lack of working capital and agricultural credit, routine, antipathy toward strangers, plunderings, lack of water, devastations of locusts, heavy taxes, lack of means of communication, and ignorance and indifference on the part of the natives.

The agriculture of Kamerun, Fourneau and E. Annet (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 4, pp. 148–224*).—This is a description of the native agriculture of this colony, its principal exports, the results of German colonization, and its agricultural future.

Native agriculture in the upper Sénégal-Niger district, Raffin (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav., vol. 4, pp. 309–329*).—Notes on the principal crops and live stock of the region, possibility of irrigation, and transportation facilities are given. Encouragement of immigration is urged.

Agricultural statistics of Belgium and the Belgian Kongo (*Ann. Statis. Belg., 45 (1914), pp. 263, 264, 362–391, 540–577*).—These pages continue statistical data previously noted (E. S. R., 32, p. 288), with additional information relating to the Belgian Kongo.

Report of crop conditions and yields [in Austria], 1915, 1916, 1917, 1918, and 1919 (*[Austria] K. K. Ackerbaumin., Ber. Stand Feldfrüchte, etc., 1915, pp. [25]; 1916, pp. [30]; 1917, pp. [29]; 1918, pp. [29]; [Austria] Staatsamt Land u. Forstw., Ber. Stand Feldfrüchte, etc., 1919, pp. [25]*).—These reports, compiled by the Imperial Ministry of Agriculture for the years up to and including 1918 and thereafter by the National Commission of Agriculture and Forestry, indicate conditions of wheat, rye, barley, oats, clover, meadows, potatoes, sugar beets, and fodder beets in Provinces of Austria by months on a scale in which 1 indicates very good, 2 above the average, 3 average, 4 below the average, and 5 very poor. Notes on weather and seasonal crop conditions are also given.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 2 (1920), Nos. 19, pp. 289–304, figs. 2; 20, pp. 305–320*).—Weekly and monthly summaries, brief articles on domestic movement, imports, and exports, prices and the situation in the market of specified commodities, and important classes of agricultural products, as well as analyses of conditions affecting the same, and foreign market information are given in these numbers.

Leading articles in No. 19 indicate rising prices for most grades of live stock, but downward trends in grass seed prices and a slow market for condensed and evaporated milk. In No. 20, yearly average wholesale hay prices from 1910 to 1919, inclusive, are reviewed, indicating an almost uninterrupted decline in relative values during the last 10 years of all classes of hay. Other special articles relate to low prevailing prices for peanuts and to decreases in English butter importation due to shortage in sources of supply.

AGRICULTURAL EDUCATION.

[Agricultural and home economics instruction in Wisconsin], H. N. Goddard and H. C. Goodspeed (*Wis. Dept. Pub. Instr. Bien. Rpt., 1916–1918, pp. 17–19, 35–47, fig. 1*).—This is a report on two years' progress, 1916–1918, in instruction in agriculture and home economics in the high schools and county schools of agriculture and home economics in Wisconsin. An unusual development in this instruction in the high schools during these years is reported.

One of the county schools of agriculture and home economics was closed in 1917–18, leaving only 6 in operation. While the attendance of these schools as a whole has not grown as had been hoped in view of the large expenditure of money on them, it is maintained that they have accomplished a large amount of valuable work both among the students and farmers. A State supervisor who has made a special study of these schools concludes that their plan of work must be so related to the regular public-school system that pupils may go from the agricultural school at any time to the regular system without serious loss of time or credit. It is believed, further, that the primary problem of these schools does not involve a course of any particular length, though it is probable that all of the schools should continue as in the past to offer a two-year course leading to a diploma for those who do not go further.

Statistical data relating to the schools and to the winter term courses are included. The teaching of home economics through the home-project method is also discussed.

Agricultural instruction for rural and city schools (*Agr. Gaz. Canada, 7 (1920), No. 8, pp. 684–688*).—A series of articles in which education officials in Nova Scotia, New Brunswick, Quebec, Ontario, Saskatchewan, and British Columbia state briefly how elementary agricultural instruction for city schools differs or should differ from that given in rural districts in these Provinces.

Milk testing in schools (*Agr. Gaz. Canada, 7 (1920), No. 8, pp. 688–691*).—Brief statements are given on the extent to which milk testing has been carried on in the schools of Nova Scotia, Quebec, Ontario, and Manitoba.

List of agricultural and horticultural officials, institutions, and organizations (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. en Meded. Dir. Landb., No. 2 (1920), pp. 163*).—This is the annual official organization list of the Direction of Agriculture of the Department of Agriculture, Industry, and Commerce, including higher and secondary agricultural education and research institutions, agricultural and horticultural winter schools and courses, itinerant instructors, associations, etc., in the Netherlands in 1920.

Veterinary education and research in South Africa, A. Theiler (*Union So. Africa, Dept. Agr. Bul. 5 (1920), pp. 6*).—The author explains the objects, organization, and ideals of the veterinary faculty recently established as an integral part of the University of South Africa.

The first two years of the course, including the pure science subjects and veterinary anatomy and physiology leading to the degree of B. S. in veterinary subjects, are to be given at the Transvaal University College. The third, fourth, and fifth years of the course, consisting of more specialized professional training, are to be undertaken at the Research Institute at Onderstepoort in conjunction with veterinary research. The institute is to remain under the administration of the Department of Agriculture, which will make financial provision for the research and instruction work. The author was placed at the head of all the activities at Onderstepoort.

State plans for vocational education in Indiana, 1920–21 (*Ind. Bd. Ed., Ed. Bul. 42 (1920), pp. 81*).—This is a statement of the requirements with reference to the administration and supervision, plant and equipment, courses of study, method of instruction, qualifications of teachers, supervisors, and directors, and teacher training for vocational education in Indiana for 1920–21. The text of the Indiana vocational law is included.

Requirements and materials for vocational agriculture, D. M. Clements (*Tenn. Dept. Pub. Instr. Bul. 4 (1920), pp. 32, pl. 1*).—This bulletin contains the requirements of the Smith-Hughes Act for Tennessee for 1920–21, including an outline of a four-year course in vocational agriculture, lists of required equipment for white and colored schools, a paper on Farm Shop Work for

High Schools, by L. M. Roehl (E. S. R., 44, p. 193), and lists of reference books and bulletins.

Virginia public schools education commission survey and report (*Richmond, Va.: [State Supt. Pub. Instr.], 1919, pp. 400, pls. 9, figs. 7*).—This is a report, together with recommendations, on the laws, conditions, and needs of public schools in Virginia, by a commission appointed by the Virginia General Assembly in 1918. The commission analyzes the present status and outlines the proper development of agricultural and home economics education in Virginia.

Report of biology teachers on recommendations for a new course of study for the high schools of Chicago (*School Sci. and Math., 20 (1920), No. 7, pp. 642–644*).—An outline is given to show in concrete form the extent to which biological training contributes to the seven main objectives of education, viz, health, command of fundamental processes, worthy home membership, vocation, citizenship, worthy use of leisure, and ethical character, as set forth by the National Commission on the Reorganization of Secondary Education, appointed by the National Education Association.

Biology and agriculture as training for citizenship, E. C. Johnson (*School and Soc., 12 (1920), No. 299, pp. 214–218*).—This is a discussion of how a study of biology and agriculture prepares for the primary duties of citizenship, and is based on the replies received to a questionnaire sent to the teachers of biology and agriculture in the secondary schools of the State of Washington. The suggestion that "the student of these subjects searches for, knows, follows, and loves the truth," is considered by the author the most important of a large number of suggestions received.

A course of practical chemistry for agricultural students, Vols. I; II, part 1, L. F. Newman and H. A. D. Neville (*Cambridge, [England]: Univ. Press, 1920, vol. 1, pp. 235; 1919, vol. 2, pt. 1, pp. 122*).—These are the first volumes of a series of laboratory manuals in practical agricultural chemistry designed to cover a three years' course for the students in agricultural science at Cambridge University.

The first volume, which is intended to cover the first year's course on the chemistry and physics of the soil, contains several chapters of laboratory directions for general inorganic chemistry, schemes of analysis for soil or plant ash and for the identification of manures, special methods for the analysis of different manures and soils, and several chapters on general physics. The second volume covers the second year's course on the chemistry of foods. Part 1 deals with qualitative exercises in organic chemistry essentially for agricultural students. This is to be followed by part 2, dealing with quantitative estimations and technical analyses of foodstuffs.

Seventy laboratory exercises in animal production, P. W. Fattig (*Gainesville, Fla.: State Bd. Vocat. Ed., 1920, pp. 92*).—The object, materials, method, and review questions for 70 laboratory exercises in animal production are outlined.

Farm shopwork in Pennsylvania, F. T. Struck (*Penn. State Col., Rural Life Dept., Spec. Bul. 1 (1920), pp. 85, figs. 20*).—This bulletin contains a study made in Pennsylvania (1) of construction and repair work performed by farmers in wood, concrete, iron, and steel, and of such work done by expert mechanics such as carpenters, concrete workers, and blacksmiths; and (2) of the teaching force and various phases of farm shopwork carried on in the vocational agricultural schools and vocational agricultural departments in public high schools in Pennsylvania. The author gives his deductions and conclusions as to the aim or purpose of teaching farm shopwork as a part of vocational

agricultural education, the kind and size of work that should be undertaken, materials, standards of workmanship, the desirable shop, equipment and its arrangement, method in farm shopwork, and mechanical drawing as related to farm shopwork. An appendix includes a list of minimum equipment and a selected bibliography for farm shopwork.

The home project method of instruction in vocational agriculture, W. T. SPANTON (*Ohio Teacher, 41 (1920), No. 1, pp. 12–15*).—The author discusses the educational value of the home project method of instruction in agriculture and some essentials of successful home project work.

Farm cadet report, A. D. DEAN (*Albany, N. Y.: State Military Training Com., 1918, pp. 116, pls. 10*).—This is a report, by the bureau of vocational training of the Military Training Commission, on the farm cadet movement in the State of New York as it was developed in the summer of 1917. Letters pertaining to the employment of boys on farms and a summary of the bureau's recommendations on farm cadets and farm camps are included.

MISCELLANEOUS.

Cooperative relations in agricultural development, E. T. MEREDITH (*U. S. Dept. Agr., Off. Sec. Circ. 153 (1920), pp. 13*).—This is the address of the Secretary of Agriculture before the Association of Land-Grant Colleges, noted editorially (E. S. R., 43, p. 704).

Report of Kansas Station, 1919 (*Kansas Sta. Rpt. 1919, pp. 88*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1919, and a report of the director summarizing the work and publications of the station. The experimental work recorded not previously noted is for the most part abstracted elsewhere in this issue.

Report of Porto Rico Station, 1918 (*Porto Rico Sta. Rpt. 1918, pp. 24, pls. 2*).—This contains the organization list, a summary by the agronomist in charge as to the general conditions and lines of work conducted at the station during the year, and reports of the horticulturist, entomologist, assistant chemist, assistant in plant breeding, specialist in farm management, and agricultural technologist. The experimental work reported is for the most part abstracted elsewhere in this issue. The report of the specialist in farm management contains statistics as to the production of five important crops and the number of live stock on the island.

Experiments in farming: Annual report of the director of the experiment station for 1918–19, H. L. RUSSELL and F. B. MORRISON (*Wisconsin Sta. Bul. 319 (1920), pp. 76, figs. 29*).—This contains an account of the activities of the station, brief summaries of the station publications for the year, and a financial statement as to the Federal funds for the year ended June 30, 1919. The experimental features not previously reported are for the most part abstracted elsewhere in this issue.

Reliable agricultural information and how to secure it, A. B. CONNER (*Texas Sta. Circ. 23 (1920), pp. 16, figs. 8*).—This circular lists the publications of the station available for distribution, with brief summaries of a number of typical publications.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 7, pp. 97–112, figs. 3*).—In addition to articles abstracted elsewhere in this issue, this number contains a brief article entitled: Concerning Dairy Rations, by W. A. Linklater.

NOTES.

California University and Station.—The poultry division is building four poultry houses to be rented to students carrying on poultry projects.

Dr. George H. Hart, associate professor of veterinary science, has been granted leave of absence for the balance of the fiscal year. During this period he will be associated with extension work in animal hygiene which is being begun by the Department of Veterinary Medicine of the University of Pennsylvania.

F. W. Woll, professor of animal nutrition, has returned from six months' leave of absence spent in Norway and England.

B. A. Rudolph of the Bureau of Plant Industry, U. S. Department of Agriculture, has been appointed research associate in plant pathology to develop further tests of the control of apricot brown rot by spraying in spring.

Florida University and Station.—Dr. Wilmon Newell has been appointed dean of the college of agriculture and director of the station and extension service.

Georgia Station.—R. P. Bledsoe, assistant agronomist of the West Virginia Station, has been appointed agronomist beginning January 15.

Illinois University.—H. W. Day, instructor and first assistant in olericulture, resigned December 15, 1920. Recent appointments include Virginia Weaver as associate in home economics, beginning February 1; O. S. Schaeffer as associate in landscape gardening; and Lena C. Rhue as assistant in farm organization and management.

Purdue University and Station.—H. J. Reed has been appointed assistant director of the station, and T. A. Coleman, assistant director of agriculture extension.

Kansas College and Station.—The college is asking the legislature for appropriations aggregating $1,686,950 for 1922 and $1,754,250 for 1923. This includes an increase of 40 per cent for salaries, from 25 to 30 per cent of which would be for the present staff. The construction of the west wing of the agricultural building in order to house the dairy department, creamery, and a meat laboratory is estimated for at a cost of $100,000 in 1922 and $284,300 in 1923. The building program also includes $100,000 for the central portion of a veterinary clinic building, $200,000 for an additional domestic science and cafeteria building, and $75,000 for remodeling the auditorium. Another item is $65,000 for the purchase of a tract of 256 acres of pasture land adjoining the college grounds. These estimates do not include the substations, for which a total of $56,155 is desired in 1922 and $36,800 in 1923.

For the second consecutive year the students' dairy judging team was awarded first place in the intercollegiate judging contest, participated in by twenty-one teams, at the National Dairy Show in October, 1920.

The second annual field superintendents' creamery short course was held in October with a total of 85 students registered, mostly employees or officers of creamery companies. The course lasted five days. A bakers' short course was held during the week ended January 15, with an attendance of about 100 students.

F. E. Fox, assistant professor of poultry husbandry; B. C. Zimmerman, instructor in animal husbandry; and Miss Blanche French, research assistant in agricultural economics, have resigned. F. W. Bell, associate professor of animal husbandry, has taken up work in swine investigations, succeeding E. F.

Ferrin, resigned to become professor of animal husbandry in the University of Minnesota. B. M. Anderson has been appointed assistant professor of animal husbandry and assistant in horse investigation in the station, taking up the work formerly carried on by Professor Bell. L. F. Payne, professor of poultry husbandry at the Massachusetts College, has been appointed associate professor of poultry husbandry. B. F. Barnes has succeeded J. J. Bayles, resigned, as superintendent of the Colby Substation.

Minnesota Station.—W. H. Kenety, assistant professor of forestry and superintendent of the forest station at Cloquet, resigned March 15 to accept a position with a large lumber company.

Nevada Station.—Arrangements have been completed by which the entire station farm will be allotted to the department of range management for use in feeding experiments, having in view the production of better lambs and the feeding and finishing of range ewes and lambs, and a study of the poisonous plants of the sheep and cattle ranges.

New Hampshire Station.—George F. Potter has been appointed horticulturist, vice J. H. Gourley; S. W. Wentworth, assistant horticulturist; and C. P. Spaeth, assistant chemist.

Rutgers College.—Dr. Frank App has been given a year's leave of absence to become secretary of the State council of county boards of agriculture.

New Mexico College and Station.—The position of professor of agronomy and agronomist has been filled by the appointment of George R. Quesenberry, formerly in charge of the college farm. Donaldson Ryder, assistant agronomist, has resigned to engage in farming and has been succeeded by W. T. Conway, assistant State leader of boys' and girls' club work.

New York State Station.—Myron W. Finch, assistant in research (bacteriology), has resigned to become instructor in physiological chemistry in the Buffalo Medical College. N. F. True has been appointed assistant chemist and has entered upon his duties.

North Dakota Station.—Because of lack of appropriations the Office of Dry-Land Agriculture Investigations, U. S. Department of Agriculture, has discontinued cooperation with the substations at Hettinger, Edgeley, and Williston, but for the present is continuing cooperation at Dickinson. Charles H. Ruzicka has resigned as superinendent of the Williston Substation.

J. W. Haw, who resigned December 15, 1920, as assistant county agent leader to become animal husbandman in the station, has subsequently resigned that position to become county agent leader vice H. B. Fuller, who has recently been elected secretary of the newly organized State Farm Bureau. Enoch Peterson has resigned as station poultryman, effective February 1.

Ohio Station.—Charles E. Thorne, director since June, 1887, has been released from the directorship at his own request, but remains in charge of the station's investigations in soil fertility. C. G. Williams, agronomist since 1902 and associate director since 1917, has been appointed acting director.

Pennsylvania Institute of Animal Nutrition.—Raymond Peterson has been appointed assistant in animal nutrition, beginning December 1, 1920.

Washington College and Station.—A conference of the agricultural interests of the State, called by President E. O. Holland for the purpose of considering a broad policy for the development of the college and its relation to the agriculture of the State, met at Pullman, December 1–3, 1920. There were present 52 delegates, representing each geographic district and each important line of agriculture. After a careful study of the program under which the institution is now working and a proposed program for the next year, the conference adopted recommendations to be presented to members of the next State Legislature.

The value of the experiment station and extension service was recognized in a recommendation that increased appropriations double those in the proposed budget be granted for these lines of work. Specific recommendations were also made for increased appropriations for the work in breeding cereals in smut resistance, investigations in horticulture conducted by the main station, more work with small fruits at the Western Washington Substation, cattle and sheep range management studies, investigations of animal diseases, and an increase in the beef and dairy herds and flocks at the college to furnish increased facilities for class instruction. Increased poultry equipment was favored as soon as funds permit, and an appropriation for studies of methods of land clearing and the handling of cleared lands was advocated. The investigational work under way in farm management and marketing attracted much interest, and recommendations were made for further emphasis in these lines. The work of the Farm Bureau and Office of Farm Markets was indorsed.

The interest of the State in the entire institution was demonstrated by recommendations for a general increase in funds for maintenance and a staff and salary scale equivalent to that in "land grant colleges of the highest grade." The conference also suggested the establishment of fellowships by commercial organizations and industries for work on specific problems and the provision of similar endowment funds by men of means.

Association of Feed Control Officials.—This association held its twelfth annual meeting at Washington, D. C., November 18–19, 1920. Following the address of the retiring president, A. J. Patten, which dealt with the duties of control officials, uniform feed control laws, and the standardization of rulings, Miss B. H. Silberberg of the U. S. Department of Agriculture explained the work of the Bureau of Chemistry in the microscopic examination of feeding stuffs, and G. A. Olson discussed the new feeding stuffs law of the State of Washington. In an address on The Influence of Fiber on Swine Rations, C. M. Vestal reported feeding experiments at the Indiana Station, showing the poor utilization of fiber by hogs. L. A. Maynard spoke on the The Utilization of Low Grade Feeding Materials and R. W. Chapin on Progress in Feed Manufacturing. Nine official and several tentative definitions were adopted.

E. G. Proulx of Indiana was elected president and G. G. Frary of South Dakota vice-president. A. W. Clark of Geneva, N. Y., remains as secretary and treasurer, and W. H. Strowd of Wisconsin replaces Mr. Proulx on the executive committee, the remaining members being L. A. Fitz of Kansas and J. K. Haywood of this Department.

American Association of Soil Survey Workers.—The first annual meeting of this association was held in Chicago, November 19–20, 1920. Representatives from ten States and the Bureau of Soils, U. S. Department of Agriculture, were in attendance. The program included papers on Iowa Experiences on the Classification and Nomenclature of Soils, by W. H. Stevenson and P. E. Brown; How Can Our Field Methods be Improved? by Guy Conrey; Utilization of Soil Surveys, by M. F. Miller; Securing Effective Legislation, by A. T. Wiancko; What Correlative Laboratory Work Is It Desirable To Do? by M. M. McCool; Soil Reconnoissance of The Northern Great Plains, by C. F. Marbut; and Soil Color Standards, by J. Gladden Hutton.

Officers were elected for the ensuing year as follows: President, M. F. Miller; vice president, A. T. Wiancko; and secretary-treasurer, W. J. Geib. The 1921 meeting is to be held in East Lansing, Mich.

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It is a truism to say that the working force of an experiment station is the primary measure of its strength. Other factors contribute, but they are effective only as they bear on the personnel. Funds, buildings, equipment are merely means to an end, and become sources of actual strength in proportion as they are employed in ministering to the success of a capable force of workers.

If the man power of the stations is the fundamental factor in research, growth in capacity for research may be indicated by the size and the character of the staff and the extent to which it is able to concentrate upon that type of activity. Unless conditions in this respect show actual improvement the essential element of growth is lacking, and investigation instead of increasing in amount and effectiveness may be found to be maintaining a stationary position or even slipping backward.

A comparison of strength and progress from this point of view may be made by going back ten years, to the time when the funds under the Adams Act were just maturing, and examining the station forces then and now. The data in the list of college and station workers published in 1911 and those in the corresponding list now under revision furnish opportunity for such a study.

As far as the total number of persons of technical grade assigned to the station staffs is concerned, some increase is to be noted, but it is not clear that this represents an actual increase in man power. When we come to examine the situation features develop which indicate that the increase may be more apparent than real. It is evident, in the first place, that the larger number is partly due to the growing tendency of some institutions to list on the station staff practically everyone who might carry on investigation in connection with advanced courses or otherwise. There is less discrimination in constituting the station staff than there was previously, particularly at some of the larger colleges, and at the present time it does not always represent the definitely organized body actively engaged in station work which it formerly did. As a matter of fact, at several of the colleges there is no attempt to constitute a station staff apart from the faculty as a whole, with definite responsibilities for organized investigation, and there is little distinction between the

work of graduate students in degree courses and the systematic investigation carried forward under definitely constituted station projects. To that extent any attempt to measure the size of the station staffs with accuracy is defeated at the outset.

Furthermore, a careful count shows that there were many more persons engaged exclusively in the service of the stations ten years ago than there are to-day. The practice of requiring dual service from station employees has considerably increased. Thus, at the beginning of 1911 a little less than 43 per cent of those on the station staffs had teaching or other duties in the colleges, while at the present time the proportion is fully 60 per cent. Moreover, in the past year or two the relative amount of college work required of these people has considerably increased owing to the difficulty of finding instructors, frequently reducing by a considerable degree the amount and the quality of investigation performed. This illustrates the fact that a little classroom work in connection with investigation may often result in the reverse—a little investigation as an adjunct to much teaching.

Another factor to be mentioned is the smaller number of persons of the assistant grade at the present time. There are many vacancies in that grade at the stations which can not be filled because the necessary funds are lacking. The burden therefore falls the more heavily on heads of departments and project leaders, the main reliance of the research branch, who with lessened help are under the necessity of carrying larger college duties. We need more assistants not only to afford relief in the teaching and the experimental work, but in order that a larger number of men in training may be coming on.

It is to be remembered also that the list of station workers includes those engaged in inspection and regulatory work, the amount and variety of which has increased rather than otherwise in spite of the transfer of the administration of regulatory laws to departments and commissions of agriculture in several States. There is no question also that there has been a large increase in farming operations under the stations, which have taken much of the time and added to the responsibilities of the staff. In not a few cases the station now carries on the college farm, or horticultural department, or creamery, and in others the line is rather loosely drawn. In a number of instances heads of departments have done little else for the station of late than manage these farms, build up herds, and operate industrial plants with a small minimum of actual experimental work.

It is necessary to call attention to these matters when comparisons are made to show the direction in which we are going or the place at which we have arrived. The extent to which the commercial operations have grown is evidenced by the increase in sales from $202,000 in 1911 to about $1,320,000 in 1920, or 650 per cent. In the same time

the State appropriations increased less than 300 per cent, or considerably less than half as much as the sales. Again, the sales accounted for 5½ per cent of the total station revenues in 1911, whereas they constituted nearly 18 per cent last year. These sales are only in small part an actual asset to the research fund, and while they often represent a helpful use of facilities they frequently mean a considerable drain upon the station's working force.

Everything considered, it is very doubtful whether the stations can be said to have actually increased in available man power in the past decade, and as measured by the last year or two it is evident that they have lost considerably in the degree of concentration of their forces on investigation, particularly persons of advanced grade.

But how have we progressed with respect to quality of the personnel? Surely with the more taxing nature of the problems at the present stage a better prepared and more resourceful staff is required to make advance. The most tangible evidence for judging of this is supplied by the advanced degrees which members of the staffs have taken. This is not absolute, but indicates a course and an experience passed through which is designed to give fitness for guiding and conducting investigation of various grades.

Of the total staff in 1911, 32 per cent had taken advanced degrees beyond the bachelor course, and in 1921 there was an increase to 48 per cent. A relatively small fraction of the degrees were beyond that of the master's; only 8½ per cent of the whole force in 1911 and 15 per cent of the present force had taken the doctor's degree. This increase in the proportion of workers having second degrees is gratifying as showing a considerably higher academic standard than ten years ago; but considering the expert nature of the stations' activities, the fact that less than a third of the whole staff then and less than half now have gone beyond the bachelor courses points to a situation which is likely to prove a handicap in original inquiry.

The above applies to the staff as a whole. Of the administrative heads of the stations, 80 per cent in 1911 had advanced degrees, and only 60 per cent in 1921, while the proportion with earned doctorates was 17 in 1911 and 18 at present. In the case of department heads and project leaders the showing is naturally better than for that of the staff as a whole. In 1911, 61 per cent of these had advanced degrees, 21 per cent the Doctor of Philosophy; while at present nearly 75 per cent have second degrees, 32 per cent of them the doctorate.

Of the assistants, 20 per cent showed evidence of advanced study in 1911, and 38 per cent in the case of the present forces. The largest gain in academic standing therefore was in the case of assistants, the proportion nearly doubling in ten years. This shows an increased

realization on the part of young recruits of the importance of advanced study in entering this field. The gain of less than 25 per cent in the department heads and project leaders having a second degree is doubtless accounted for by the loss of many in this class and the consequent advancement in some cases of persons of less training, necessitated by the pressure for men. It is not necessarily to be taken as a lowering of the academic requirements for such positions, but a reflection of unfavorable conditions. As a matter of fact, there has been wide search for persons possessing special qualifications for original inquiry in particular lines, and although this has met with only partial success it expresses a feeling which has steadily become more pronounced.

The showing of academic qualifications on the part of station employees apparently surpasses that of the teaching force in the same colleges. Opportunity for comparison is presented by data recently gathered by the standing committee on instruction in agriculture, home economics, and mechanic arts, and presented to the Association of Land Grant Colleges at Springfield. According to that report, only 14 per cent of the instructors in these subjects and 38 per cent of the assistant professors have taken any degree beyond the bachelor's. Similarly, only 44 per cent of the associate professors and 47 per cent of the full professors now have a second degree; whereas 48 per cent of the entire station forces in 1921 had master's or higher degrees, and 75 per cent of the department heads and project leaders. These data apply to the combined teaching forces in agriculture, home economics and engineering, without segregation by subjects. Of the college teachers of agriculture less than 9 per cent possessed a doctor's degree, while for the entire station staff the proportion was 15 per cent and in case of heads of departments and projects leaders, 32 per cent.

This showing for the collective forces of the colleges led the committee to urge quite strongly the necessity of higher academic standards in the teaching departments, and to express the hope that the present unsatisfactory condition should be regarded as temporary. It recommended that candidates for the position of instructor be carefully considered, not only with reference to their academic and technical training, but also with reference to their capacity for growth; and it further advised that the period of employment as instructor be clearly defined as a time of trial and opportunity for graduate study, those failing to show capacity for growth to be dropped. A liberal policy in making arrangements for part time graduate work or in granting leave for advanced study was suggested as important in encouraging the development of promising material.

These suggestions may be quite as pertinently applied to recruits in the station forces. There is no advantage in encouraging the be-

lief that station positions do not require special and severe training, or that persons who do not press forward in their graduate work may look to steady advancement to the higher posts.

Collegiate degrees are not of course to be taken as an absolute measure of qualification for research, any more than a degree may express ability in any other scientific or professional branch. Degrees are merely an evidence of work done in meeting stipulated requirements, not always of uniformly high standards but of advanced character, and they take only partial account of native ability. But as far as they go, they indicate a grade of preparation which should give insight into the spirit and method of science, add to the general familiarity with the subject matter, and pave the way for self-instruction. The courses which lead to them supply a background obtained under associations and supervision which while not indispensable to the exceptional person are not easily gained otherwise by the average one. Such systematic and intensive training stimulates love for study which will make for a constant strengthening of the individual equipment for research.

It is manifest that a considerable number of persons long connected with the stations have risen to high position through experience and a demonstrated capacity for investigation which imply more than any degree. They go to make up the strength of the station forces in some of the most advanced and taxing lines. No one would underrate their high value, their directing force, the influence they have had in making the station work practical while scientific. But they have been among the first to recognize the advantage of thorough preparation as a basis for successful research, and they have not infrequently expressed a feeling of handicap in extending their own inquiries. No one can say that they might not have proven even more resourceful and productive if they had started with such a background of training as it is now easy to obtain.

It is true also that useful as is this preliminary preparation—and it can hardly be too thorough or rigorous for the demands of agricultural problems—the power to conduct original research with marked success is largely a personal quality. It may be trained and developed but it can not be initiated; it may be brought to light and stimulated, but unless it is inherent in the individual it can not be induced. This, however, does not weaken the argument for a kind of preparatory training which, while disclosing capacity in that direction will give a favorable start and a freer opportunity for the exercise of native ability.

To see clearly the real problem, to visualize the means of approach, to frame the plan for solution, to weigh the results for what they

really are and in their rightful meaning, and at all times to maintain a critical, exacting attitude toward one's work—these are attributes of the genuine investigator. Because he is cautious he need not be obsessed with the idea of what he does not know, but on the contrary the feeling of strength and confidence in work which stands the test will give him courage and self-reliance. Patience comes with an understanding of the necessarily measured steps by which advance is made in knowledge that is scientifically sound; and concentration upon a clear-cut theme evidences ability to see the real nature of a complex problem and resolve it into parts which are feasible of study.

Naturally it will be said that lack of sufficient funds supplies the reason for the present man power of the stations—lack of funds to pay salaries calculated to attract highly trained men and encourage others to prepare for a career in the stations. This is largely true as to the effect of the salary, and inability to remedy the situation is mainly a matter of funds; but to some extent the reason for the salary scale may lie deeper than the station's ability to pay.

The salary has clearly not been sufficiently attractive to draw and hold the type of persons needed for work in advanced lines. It has not been possible to advance it with the scale of opportunity in other lines, but its size has not always reflected the condition of station funds. In some instances it has been kept down by other considerations beyond the control of the stations. Sometimes these are local and sometimes a product of State legislation. The latter seems on the increase. When a highly trained man, with a passion for research which has made him a recognized specialist in advanced lines, is compelled to resign and accept a commercial position against all his personal preferences and inclinations, because the legislature has fixed the salary at $3,000, the situation is an alarming one for research. The reasonable reward denied him will hold others away, and a promising line of study for which much money has been spent in preparation is indefinitely suspended.

The effect is similar when a rigid salary scale throughout the entire college prevents the recognition of special ability in the field of research, even though the station may have the means to command or hold superior talent. Where the stations share their staff with the teaching branches the salary is likely to be measured quite as much by success with students or practical men, or by ability to make a favorable showing for the department in question, as by the amount and grade of investigation. This is probably because work in the station attracts less attention from the authorities unless something brings it into prominence. Again, heads of departments receive the ranking salary, and subordinates, even though

they may be men of ability in research, are graded according to their rank in the departmental staff. In the case of large departments this factor may seriously detract from the outlook and make it practically impossible to advance men of distinction in research.

Appreciation of research is increasing at the colleges. There has been great advance in that respect at most institutions in the past decade. But the type of organization that has been developing there has not tended to emphasize the position of the research staff or afford it encouragement commensurate with the preparation and quality of service it represents. And beyond this, there is increasing tendency to take the matter of salaries out of the hands of the college authorities and place them with the legislature, or a general supervisor of administration, or other State officers remote from the institution. This bears upon the station more seriously than upon any other branch of the institution. It takes away the stimulation of earned reward, and in large measure it eliminates the judgment and support of the official in immediate charge. There is no channel of approval or means of protection from competition. Indeed, advancement as a result of good work must be looked for from outside the institution rather than within. This is a severe blow to the stations involved, which it is hoped will become so apparent as soon to be removed.

To this extent, then, the funds of the station are not wholly the determining factor in the matter of personnel. Other places in the college require less effort and expense in preparation and promise more rapid advancement. The outlook in station work has not been particularly stimulating to the thoughtful young man.

In order to have a more highly efficient working force than the stations had ten years ago it is necessary to have more specialists of advanced training and success in research than there were then, that they be given opportunity to concentrate upon their problems, that they have more helpers rather than that they be required to do more of the routine manual operations themselves, and that there be opportunity for recognizing special ability in this most exacting type of service. There must needs be opportunity to rise to as high a rank and salary through research as through administration, teaching, or any other line of activity. Every consideration merits this. Until conditions permit it, increased funds will not wholly solve the stations' difficulties or enable them to rise to the full height of the service open to them.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Principles of biochemistry, T. B. ROBERTSON (*Philadelphia: Lea & Febiger, 1920, pp. XII+17–633, figs. 56*).—The author states in the preface that, while it has been his design "primarily to write a textbook for the use of medical students and students intending to specialize in biochemistry and physiology, the attempt has also been made to compile a work which will be of service to the agricultural student, the student of general biology, or the industrial chemist who is engaged in handling biological products."

An introductory section includes a brief discussion of the nature and scope of biochemistry, the degree of exactitude obtainable in it, and the preparation required for its study, and an outline of the general scheme followed in the treatment of the subject. The subject matter proper is divided into six parts corresponding with various phases of the cycle of changes which the foodstuffs undergo in the body until their final products are excreted. These subdivisions are essentially as follows: (1) The foods, their properties, digestion, assimilation, conversion into living matter or into reserve materials; (2) the properties of protoplasm as determined by the properties of the foodstuffs; (3) the chemical correlation of the tissues; (4) the chemical processes which underlie and accompany life phenomena; (5) the waste products resulting from the activities of the tissues; and (6) the energy balance of the organism. At the end of each chapter an extensive list of general and special references to the original literature is given.

The volume closes with a prophetic discussion in which the author suggests possible future lines of development of biochemistry, including a fuller understanding and control of the photochemical synthesis of organic compounds, the synthesis and control of artificial enzyms leading to the factory synthesis of foodstuffs, a wider utilization of the various products and constituents of living matter, further advances in knowledge of the time relations of the growth process in animals and crops, expansion of the knowledge of the metabolism and symbiotic relations of bacteria, and a fuller understanding of the mechanism of immunity.

Does gliadin contain amid nitrogen? T. B. OSBORNE and O. L. NOLAN (*Jour. Biol. Chem., 43 (1920), No. 2, pp. 311–316*).—Evidence that the nitrogen which is converted into ammonia by boiling proteins with acids is an amid combination is furnished by reported experiments with gliadin. The acidity developed on boiling gliadin with dilute acid was found to be closely proportional to the amount of ammonia, thus indicating that ammonia originates from R–$CONH_2$ groups. The presence of more than very small amounts of uramino groups, R–CH.NH.$CONH_2$, is thought to be excluded by the fact that very nearly as much ammonia is produced by boiling gliadin for a short time with 1 per cent HCl as by boiling for 24 hours with 20 per cent HCl.

Gas production during the acetone and butyl alcohol fermentation of starch, H. B. SPEAKMAN (*Jour. Biol. Chem., 43 (1920), No. 2, pp. 401–411, figs. 2*).—In continuation of the investigation previously noted (E. S. R., 42, p.

708), it was found that the gas produced at the beginning of the fermentation is pure hydrogen, but that the amount of this gas immediately begins to fall due to the production of CO_2 in increasing amounts. After a period of about 5 hours the percentage of H_2 in the gas falls more rapidly during several hours, although the rate of total gas production at the same time increases. At the point of maximum acidity of the mash the rate of gas production diminishes temporarily, while the percentage of H_2 remains constant or slightly increases. When the rate of gas production is once more increasing rapidly the percentage of H_2 falls at a uniform rate, but later, when the rate of production of acetone and butyl alcohol begins to diminish, the H_2 in the gas rises during 4 to 6 hours from 33 or 34 per cent to 38 or 40 per cent. Just before the end of the fermentation the content of hydrogen again drops to about 33 per cent.

Determinations of the volume and composition of the total gas produced during the complete fermentation of a known weight of corn meal indicate that from 1 gm. of meal approximately 350 cc. of gas is produced, consisting of 47.5 parts of H_2 and 52.5 parts of CO_2 by volume.

In the light of these and earlier results the biochemical mechanism of the fermentation is considered to be represented by the following equations:

$$(1)\quad (C_6H_{10}O_5)x + xH_2O = xC_6H_{12}O_6$$
$$(2)\quad C_6H_{12}O_6 = C_3H_7.COOH + CH_3.COOH + O_2$$
$$(3)\quad 2C_3H_7.COOH + O_2 = 2CH_3.CO.CH_2.COOH + 2H_2$$
$$(4)\quad CH_3.CO.CH_2.COOH = CH_3.CO.CH_3 + CO_2$$

The formation of butyl alcohol, and to a small extent of ethyl alcohol, is considered to take place by reduction of the corresponding acids as follows:

$$C_3H_7.COOH + 2H_2 = CH_3.CH_2.CH_2CH_2OH + H_2O$$
$$CH_3.COOH + 2H_2 = CH_3.CH_2OH + H_2O$$

The synthesis of the hexaphosphoric ether of inosite and its identity with the phospho-organic reserve material of green plants, S. Posternak (*Compt. Rend. Acad. Sci. [Paris], 169 (1919), No. 3, pp. 138–140, fig. 1*).—The author claims to have synthesized phytic acid in the form of a crystalline double calcium sodium salt by heating a mixture of inosite phosphoric acid and phosphorus pentoxid. From a comparative study of the crystallography of the natural and synthetic salts it is concluded that the synthetic acid is identical with the natural phytic acid isolated from plant materials.

Crystalline chlorotetracetyl fructose and related derivatives, D. H. Brauns (*Jour. Amer. Chem. Soc., 42 (1920), No. 9, pp. 1846–1854*).

Synthesis of s-xylidine, H. L. Haller, E. Q. Adams, and E. T. Wherry (*Jour. Amer. Chem. Soc., 42 (1920), No. 9, pp. 1840–1842*).

A further study of the process of purifying pancreatic amylase, H. C. Sherman, I. D. Garard, and V. K. LaMer (*Jour. Amer. Chem. Soc., 42 (1920), No. 9, pp. 1900–1907*).—In continuation of the investigation of pancreatic amylase previously noted (E. S. R., 42, p. 202), a detailed study has been made of the purification process to determine the place and nature of the losses in activity occurring during purification. The process of purification described in a previous publication[1] was carried out with determinations of total solids and enzym activity at each step in the process where such determinations could be made.

It was found that alcohol up to 5 per cent, or alcohol-ether mixture up to 8 per cent of the volume of the substrate, did not materially affect the activity of the pancreatic amylase. When 50 per cent alcohol extracts of pancreatin were precipitated by alcohol-ether mixture, the residual solution contained

[1] Jour. Amer. Chem. Soc., 33 (1911), No. 1, pp. 1195–1204.

about 1 per cent of the active amylase and 2.5 per cent of the solids of the original pancreatin. On dispersing the alcohol-ether precipitate in water and mixing with absolute alcohol 25 per cent of the solids originally extracted remained in the filtrate which, however, showed no amylolytic activity. About 50 per cent of the amylolytic activity was lost by the end of the dialysis and about 45 per cent in the final precipitation and separation, while about 5 per cent was found in the final precipitate. The precipitate which formed in the inner solution during dialysis showed very high proteolytic and little or no amylolytic activity.

"The present experiments afford no convincing evidence as to whether or not amylase changes to protease. The difference in the rate of deterioration here observed may be due either to such a change or to greater instability of the amylase."

Alkali fusions.—II, The fusion of sodium benzene m-disulfonate with sodium hydroxid for the production of resorcinol, M. PHILLIPS and H. D. GIBBS (*Jour. Indus. and Engin. Chem., 12 (1920), No. 9, pp. 857–860, figs. 4*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, reports a study of the production of resorcinol by the fusion of sodium benzene *m*-disulfonate with sodium hydroxid in the apparatus described in the first paper of the series (E. S. R., 42, p. 503). The results of an investigation of different factors affecting this fusion indicate that "310° C. is the best fusion temperature, 2 hours the best fusion period, 14 to 16 moles of sodium hydroxid to 1 mole of sodium benzene *m*-disulfonate the best fusion mixture, and that water tends to reduce the yield of resorcinol."

Para-cymene as a solvent, A. S. WHEELER (*Jour. Amer. Chem. Soc., 42 (1920), No. 9, pp. 1842–1846*).—The author, with the assistance of T. P. Dawson, J. S. Murray, R. H. Sawyer, and H. M. Taylor, has made a study of the purification of *p*-cymene from spruce turpentine and of the solubility of various substances in the purified cymene. The purification adopted consisted essentially in drawing air at ordinary temperatures through the turpentine for about 10 hours to remove SO_2, fractionally distilling the liquid with superheated steam, the vapors passing through a 30 per cent solution of NaOH before entering the condenser, and finally shaking the distillate with 5 per cent NaOH and redistilling over metallic sodium.

Tables are given of the solubilities of various organic compounds in the cymene at different temperatures.

"Cymene assumes an important position as a solvent because it is a hydrocarbon of high boiling point, and, where possible, is to be preferred to such colored solvents as anilin or nitrobenzene or an ill-smelling solvent such as pyridin. Cymene boils at 176.5° and in point of availability comes next to xylene in the benzene series. It should be useful as a simple solvent or in mixed solvents and in molecular weight determinations where the elevation of the boiling point method is employed."

A method for the estimation of urea by soy bean, E. L. KENNAWAY (*Brit. Jour. Expt. Path., 1 (1920), No. 3, pp. 135–141*).—The method described, which was designed particularly for the estimation of urea in blood serum, differs from the usual technique in the use of an alcoholic extract of serum without evaporation and resolution in water, and in the direct titration of ammonia without removal by an air current and with the use of a simple comparator. The technique of the method is described in detail, and the results are reported of its application in solutions of known urea content, in blood serum, and in cerebrospinal fluid. The data presented indicate an accuracy of about 97 per cent.

Contribution to the study of the determination of creatinin, E. VAUTIER (*Ann. Chim. Analyt., 2. ser., 2 (1920), No. 10, pp. 300–305*).—Directions are given for the application of the Folin colorimetric method for the determination of creatinin, to its estimation in bouillon cubes. The technique is essentially as follows:

From 0.25 to 3 gm. of the substance, depending upon its probable content in creatinin, is weighed out and evaporated on a water bath with HCl, the residue taken up with boiling water, and the liquid filtered on a wet filter paper. The solution is evaporated again to dryness on the water bath after adding a few drops of concentrated HCl. After cooling the dry residue 10 cc. of water, 15 cc. of picric acid solution, and 8 cc. of 10 per cent NaOH are added and thoroughly mixed. After 5 minutes the solution is diluted to 500 cc. with distilled water and compared with the standard in the colorimeter.

Laboratory control of wheat flour milling, B. R. JACOBS and O. S. RASK (*Jour. Indus. and Engin. Chem., 12 (1920), No. 9, pp. 899–903*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, consists of a discussion of the composition of the various parts of the wheat kernel in terms of those constants which are most commonly determined on mill products in a control laboratory, leading to the suggestion of an analytical procedure for the cereal chemist, particularly the flour mill chemist, modeled after those used in control laboratories of industrial plants where samples of raw materials and of the different finished products are analyzed to determine the efficiency of factory operations.

The accompanying table, compiled from analyses of the best obtainable commercial products of the wheat kernel, shows that starch is the characteristic constituent of the endosperm, pentosan of the bran, and fat or ether extract of the germ. Consequently starch, pentosan, and fat determinations in wheat and in mill products may be used as measures of the efficiency of the milling process.

Composition of mill products of the wheat kernel.

Constituent.	First middling flour (endosperm).	Commercial bran.	Commercial germ.	Constituent.	First middling flour (endosperm).	Commercial bran.	Commercial germ.
	P. ct.	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*
Ash	0.368	6.45	4.47	Pentosan	2.25	22.72	5.38
Protein	12.08	16.49	29.89	Sugars	....	....	12.82
Cold-water extract	4.61	11.84	....	Starch	68.78	9.07	7.30
Acidity	.08	.65	....	Moisture	12.08	13.00	13.00
Fat	.75	3.58	10.02				

The amount of fat and pentosans in any grade of flour is a measure of the amount of offal (germ and bran) contained in that flour, and the amount of starch a measure of the actual amount of flour contained in the product.

Examples are given of the application of this procedure in the examination of commercial mill products and determinations of mill efficiency.

The Hortvet test, a practical method for testing butter for butter fat (*Dairy Record, 21 (1920), No. 11, pp. 20, 22, fig. 1; abridged in N. Y. Prod. Rev. and Amer. Creamery, 50 (1920), No. 18, pp. 1014, 1016*).—This test is essentially the same as the Babcock method of testing cream, involving, however, the use of special butter test bottles.

These bottles, which can be used simultaneously with cream test bottles, differ from the latter in having a specially designed stem consisting of a neck

portion about 2 cc. in length, a bulb enlargement, and a graduated tube of the same caliber as the neck, but with a cup-shaped enlargement at the top to facilitate the transfer of the sample. From the zero mark on the lower part of the stem to the top graduation of the bulb the entire volume measures 7.5 cc. On the basis of a 9 gm. sample of butter the graduations on the stem range from 75 to 85 per cent of butter fat. In reading the percentages of fat the test bottle is warmed to 140° F. and two measurements taken with callipers, the first from the extreme bottom of the fat column to the extreme top, the second from the extreme bottom to the lower line of the upper meniscus, the average of the two readings giving the percentage of fat.

A table is given of the results obtained by means of this test bottle in comparison with results obtained on corresponding samples by the Mojonnier apparatus and the gasoline extraction method.

The effect of temperature on the fat column measured in the Hortvet butter test bottle, J. Hortvet (*Dairy Record, 21 (1920), No. 21, pp. 26, 28*).—Attention is called to the different recommendations regarding the optimum temperature for reading the fat column in the modified Babcock test for fat in cream, milk, etc., particularly to the recommendation of 120° F. from results obtained by H. Klueter[1] in a study of the specific gravity of milk fat at temperatures from 120 to 140°. To determine the optimum temperature to be used with the Hortvet bottle described above, readings were made at temperatures varying by 5° each from 120 to 140°, and these results compared with results obtained on the same samples of butter by the Mojonnier tester.

While measurements made at the lower temperatures approximate more nearly the results obtained by the Mojonnier tester, the author is of the opinion that 130° is the most suitable temperature for measurements of the fat, owing to the difficulty in obtaining clear fat columns at lower temperature. It is recommended that no measurements be taken at temperatures higher than 130°.

Some observations on the determination of cellulose in woods, S. A. Mahood (*Jour. Indus. and Engin. Chem., 12 (1920), No. 9, pp. 873–875*).—Data on the effect of size of particle on yield of cellulose, and on the relative value of different modifications of the Cross and Bevan method of determining cellulose, are reported from the U. S. Forest Products Laboratory, Madison, Wis.

A uniform size of particle is considered essential if comparable results are to be obtained in the determination of cellulose in woods. Material which passes an 80-mesh standard sieve, but which is retained by a 100-mesh sieve, was found to give the most satisfactory results. Ground sawdust is thought to be as satisfactory as raspings.

Preliminary hydrolysis with acetic acid in glycerol, as recommended by Johnsen and Hovey (E. S. R., 39, p. 614), not only reduced the furfural-yielding constituents in the cellulose but also the pentoses and free cellulose. This modification is, therefore, thought to be of doubtful value. Chlorination in the Gooch crucible gave lower results than those obtained in the usual technique employing a beaker in a closed vessel.

The detection and estimation of Yellow AB and Yellow OB in mixtures, W. E. Mathewson (*Jour. Indus. and Engin. Chem., 12 (1920), No. 9, pp. 883–887*).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, includes a description of the use of light gasoline and dilute sulphuric acid of different concentrations for the detection of foreign dyes in commercial Yellow AB and Yellow OB colors, methods for the quantitative separation of mixtures of these dyes, and a few color tests for their identification.

[1] Wis. Dairy and Food Commr. Bien. Rpt. 1910, pp. 353–358.

A color test for oxalic acid, L. H. CHERNOFF (*Jour. Amer. Chem. Soc., 42 (1920), No. 9, pp. 1784, 1785*).—The test consists of dissolving a few crystals of resorcinol in about 5 cc. of the unknown solution in a test tube and adding to the cooled solution 5 cc. of concentrated H_2SO_4, pouring the acid carefully down the side of the tube. A blue ring is said to form in the presence of oxalic acid.

If the test does not appear in a few minutes the mixture is shaken thoroughly and cooled and another 5 cc. of H_2SO_4 added. If the color still fails to appear, the contents of the tube should be mixed and the tube gently warmed. An indigo blue color diffusing through the liquid will then denote the presence of oxalic acid.

It is stated that the test may be made sensitive to 1 mg. if the dry unknown substance is warmed with 2 drops of a 10 per cent aqueous resorcinol solution and the sulphuric acid added drop by drop. In the presence of interfering substances such as carotin, xanthophyll, and some terpenes which give a blue coloration with sulphuric acid alone, the author recommends the removal of the oxalic acid by precipitation as the calcium salt, after which the test is applied directly to an aqueous suspension of the salt.

Levulose sirup, J. J. WILLAMAN (*Science, n. ser., 52 (1920), No. 1346, pp. 351, 352*).—The author suggests the possibility of manufacturing levulose sirup from the Jerusalem artichoke, the fresh tubers of which contain from 12 to 14 per cent inulin yielding levulose on hydrolysis. From known yields and analyses of artichokes it is estimated that a yield of 4,000 lbs. of sugar per acre of artichokes could be obtained, as compared with about 1,600 lbs. of sugar per acre of sorghum, 3,000 lbs. per acre of sugar beets, and from 3,000 to 4,500 lbs. per acre of sugar cane.

The mutarotation of gelatin and its significance in gelation, C. R. SMITH (*Jour. Amer. Chem. Soc., 41 (1919), No. 2, pp. 135–150, figs. 2*).—In this contribution from the Bureau of Chemistry, U. S Department of Agriculture, it is shown that gelatin of the highest jelly strength approximates a definite and maximum value of mutarotation measured between 35 and 15° C., and that the jellying power decreases in weaker gelatins parallel with the reduction of mutarotation.

Determination of the jellying power of gelatins and glues by the polariscope, C. R. SMITH (*Jour. Indus. and Engin. Chem., 12 (1920), No. 9, pp. 878–881, fig. 1*).—Continuing the above study, the author has developed a table of comparisons of polariscope readings with jelly strength at different concentrations and temperatures, by means of which glues or gelatins may be graded from their polarization readings under known conditions.

A simple mechanical tester for jelly strength measurements is also described. This consists of an 80 mm. glass funnel with short stem accurately formed to a 60° angle. The funnel is first closed at the end and 120 gm. of mercury poured in. Fifty cc. of the gelatin solution is poured over the mercury and allowed to solidify in a horizontal position in a constant temperature bath at 10°. When the jelly is to be tested the mercury is allowed to run out, the funnel connected with a water manometer, and with suction, and a definite reduction of the pressure produced (60 cm. of water). The depression in the jelly is then measured by a micrometer depth gauge reading to thousandths of an inch.

METEOROLOGY.

Solar variation and the weather, H. H. CLAYTON (*Nature [London], 106 (1920), No. 2667, pp. 468, 469*).—Referring to an article by Abbot on the same subject, previously noted (E. S. R., 43, p. 908), the author gives a brief sum-

mary of the latest results and conclusions of the Argentine Weather Service, which has been engaged in studies on this subject for several years.

"The first and most striking result is that the solar radiation exerts a cumulative effect on the atmosphere, so that prolonged periods of high or low solar radiation have a much greater response in atmospheric action than shorter periods of greater intensity. . . .

"The second result is that as the sun changes from one hemisphere to another the effect on the weather changes, so that in the hemisphere where the sun is nearly vertical the pressure falls over the land surface and rises over the water surface, while the opposite effect is found in the other hemisphere. This effect I take to be a proof that a considerable part of the increased solar radiation reaches the earth's surface and intensifies the normal effect of absorption of solar radiation by the land. There are, however, clear indications that a considerable part of the increased solar radiation is absorbed by the upper air and gives origin to atmospheric waves."

It is stated that forecasts are made by the Argentine Weather Service "for a week in advance by publishing estimated temperatures for each day, and also forecasts of expected rains. With increased experience there have been steady improvements and an increasing demand for the forecasts by commercial interests."

Surveying America's snows, J. ANDERSON (*Sci. Amer., 123 (1920), No. 24, pp. 594, 603, figs. 5*).—This is an account of the use of the apparatus and methods devised by Church in a survey of the snow in the Sierra Nevada Mountains for the purpose of forecasting the stream flow of California and Nevada. It is stated that "when these surveys have become general and results have been carefully tabulated and regularly published it will be possible for farmers to determine accurately in the early spring the exact amount of water they can depend upon during the summer months or growing season for irrigation purposes, and they can thus plant their crops accordingly. Manufacturers depending upon water power to run their plants will also be able to figure how they will come out in this respect even during the driest seasons."

The essential characteristics of United States climates, R. DEC. WARD (*Sci. Mo., 11 (1920), No. 6, pp. 555–568*).—The characteristics of the eastern, Gulf, Plains, plateau, and Pacific climatic provinces of the United States, as defined in an article previously noted (E. S. R., 34, p. 14), are described.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 7 (1920), Nos. 5, pp. [202], pls. 4, fig. 1; 6, pp. [203], pls. 4, figs. 2*).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for May and June, 1920, respectively.

Weather reports [for Alaska, 1918], C. C. GEORGESON ET AL. (*Alaska Stas. Rpt. 1918, pp. 93–104*).—Tabular summaries are given of observations on temperature, precipitation, and cloudiness at 44 Weather Bureau stations in Alaska.

Climatic conditions [at Fairbanks Station, Alaska], M. D. SNODGRASS (*Alaska Stas. Rpt. 1918, pp. 55–57*).—Data regarding temperature and precipitation at Fairbanks, Alaska, for the eight years, 1911–1918, are tabulated and the general climatic conditions in the Tanana Valley during 1918 are briefly discussed. Attention is called especially to the fact that the winter of 1917–18 was the coldest recorded in this region, with nearly double the amount of normal snowfall. On the whole the weather conditions during 1918 were less favorable for agricultural work than in any preceding year since the station was established in 1907.

[Weather at the Minnesota Northwest Experiment Station, 1919], C. G. SELVIG (*Minnesota Sta., Rpt. Crookston Substa., 1919, pp. 7–9*).—Data for temperature, length of the growing season, precipitation, cloudiness, and direction of the wind at the Northwest Substation at Crookston, Minn., are tabulated and briefly discussed. Comparison of the record for 1919 with those of 1917 and 1918 and with the 10-year average shows that the mean annual temperature for 1919, 38.1° F., was nearly normal, that the annual precipitation, 22.57 in., was considerably above the normal, and that the growing season was the longest on record, namely, from May 1 to September 25.

[Weather at the Minnesota West Central Experiment Station, 1919], P. E. MILLER (*Minnesota Sta., Rpt. Morris Substa., 1919, pp. 7, 8*).—Weather conditions as related to crop growth at the substation at Morris, Minn., are briefly described. Data for precipitation during each month of 1919, except January, March, April, and September, are tabulated.

Meteorological records, E. BURKE (*Montana Sta. Rpt. 1919, pp. 42–45*).—Observations on temperature, length of growing season, precipitation, cloudiness, and direction of the wind at Bozeman, Mont., during 1919, are summarized. A record of evaporation, wind movement, temperature, and humidity from April to October, inclusive, is also given.

The mean temperature for the year was 41.4° F., the highest 97° July 10, the lowest —36° December 9. The last killing frost in spring occurred May 23, the first in the fall September 22. The annual precipitation was 11.47 in. Abnormal weather conditions were quite prevalent over the entire State during the year, and a lack of rain and high temperatures were quite general during the growing months.

Report of weather observations, W. S. SCHIEFERSTEIN (*New Jersey Stas. Rpt. 1919, pp. 101–103*).—Tables show the mean temperature of each month of the year ended June 30, 1919, at the college farm, New Brunswick; the monthly maximum and minimum means of temperature; and the daily and monthly precipitation.

The year as a whole was the warmest and the winter the mildest on record at this place, the mean temperature being 54.91° F., as compared with a 22-year mean of 50.5°. The total precipitation for the year was 42.62 in. The snowfall was the smallest on record. "Severe damage was caused in some sections of New Jersey by the heavy frost of April 2, when a minimum of 22° was reached, the damage being due largely to the advanced condition of growth for this season. Frost on April 25 with a minimum of 29° also did some damage in sections of the State where fruit trees were in bloom."

SOILS—FERTILIZERS.

Influence of moisture on the bacterial activities of the soil, J. E. GREAVES and E. G. CARTER (*Soil Sci., 10 (1920), No. 5, pp. 361–387, figs. 4*).—Studies conducted at the Utah Experiment Station on the influence of water upon the bacterial activities of 22 typical farm soils used for dry land, irrigated, manured, and unmanured farming are reported.

The soils ranged from a loose sand to a very tight clay and in organic matter content from practically none to an abundance. Their moisture-holding capacity varied from 31 to 78 per cent and was closely correlated with the content of clay and organic material. Their moisture equivalent varied from 3.32 to 45.15 and the wilting coefficient from 1.8 to 24.54. Each soil showed maximum ammonification when it contained 60 per cent of its capacity of water. Nitrification was a maximum at from 50 to 60 per cent of capacity water content and varied with specific soils. Many of the soils showed two maxima for

nitrogen fixation, one at from 50 to 60 and the other at from 70 to 80 per cent of capacity water content.

Using the Briggs formula for the moisture equivalent and the wilting and hygroscopic coefficients, the following equations are given as representing approximately the water requirements for maximum bacterial activity, where M_a, M_n, M_{nf} indicate the requirements for ammonification, nitrification, and nitrogen fixation, respectively, c the moisture capacity, w the wilting coefficient, e the moisture equivalent, and h the hygroscopic coefficient:

$$M_a=0.6c=0.942e+12.6=1.74w+12.6=2.55h+12.6.$$
$$M_n=0.55c=0.8525e+11.55=1.472w+11.55=2.163h+11.55.$$
$$M_{nf}=0.7c=1.049e+14.7=1.947w+14.7=2.848h+14.7.$$

A list of 53 references to literature bearing on the subject is appended.

The capillary potential and its relation to soil-moisture constants, W. GARDNER (*Soil Sci., 10 (1920), No. 5, pp. 357–359, fig. 1*).—This article, a contribution from the Utah Experiment Station, is a brief but very technical discussion, based on studies of several soils. The tentative conclusion is drawn that a consideration of soil moisture from the standpoint of the capillary potential gives a new interpretation of the various soil moisture constants.

Soil acidity investigation, C. S. BECKWITH (*New Jersey Stas. Rpt. 1919, pp. 455–457*).—Experiments begun in 1914 on the treatment of cranberry soils to vary the acidity, in which burned lime and pulverized limestone were used to decrease the acidity and sulphur was used to increase it, showed that increasing the acidity with sulphur is undesirable and decreasing it with lime is beneficial.

The prevention of soil erosion.—III, Filling the large ditch.—IV, The earth or Adams dam, M. H. HOFFMAN and A. W. TURNER (*Iowa Agr. Col. Ext. Bul. 77 (1920), pp. [4], figs. 5; 78 (1920), pp. [4], figs. 3*).—Continuing this report (E. S. R., 43, p. 420), part III deals with the filling of large ditches by means of straw, brush, and wire fence obstructions. Part IV deals with the earth dam, which is placed across a ditch and is provided with a concrete guard to prevent erosion of its face, and a culvert or tile drain with spillway to take care of the run-off from heavy rains.

Soil survey of the Middle Gila Valley area, Ariz., E. C. ECKMANN ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 37, pls. 3, fig. 1, map 1*).—This survey deals with the soils of an area of 225,280 acres in the Desert region of south-central Arizona, mainly in Pinal County. The area is made up almost entirely of river bottoms or smooth, nearly level plains. The retarded drainage of the southern part of the area gives rise to many shallow lakes which are dry except during heavy rains.

The soils are of residual and old and recent alluvial origin. The old alluvial soils are the most extensive, but the recent alluvial soils are of the greatest agricultural value. Including riverwash and rough, stony land, 10 soil types of 5 series are mapped, of which the McClellan loam, Mohave sandy loam, McClellan clay loam, and Gila silty clay loam cover 30.6, 17.8, 16.8, and 13.4 per cent of the area, respectively.

Irrigation is necessary to insure crops in this region. More than 50 per cent of the soils contain alkali. Sodium chlorid, sodium sulphate, and sodium carbonate predominate in the alkali crust. Sodium chlorid is by far the most abundant.

Soil survey of Sandusky County, Ohio, E. R. ALLEN ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 64, fig. 1, map 1*).—This survey, made in cooperation with the Ohio Experiment Station, deals with the

soils of an area of 264,320 acres lying mainly within the basin of ancient glacial lakes in northern Ohio. The greater part of the county is very level, but there are occasional undulating ridges. The natural drainage is very poor. The soils are included in the Glacial and Loessial and Glacial Lake and River Terrace soil provinces, and are nearly all of glacial origin. Including marsh, muck, and gravel and clay pits, 35 soil types of 14 series are mapped, of which the Brookston clay and Newton silty clay cover 25.4 and 14 per cent of the area, respectively.

Soil survey of Braxton and Clay Counties, W. Va., W. J. LATIMER and C. N. MOONEY (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 39, fig. 1, map 1*).—This survey, made in cooperation with the West Virginia Geological Survey, deals with the soils of an area of 543,360 acres lying wholly within the Appalachian Mountain and Plateau province in central West Virginia. The topography in general is steep and broken, and surface drainage is said to be excessive.

The soils are of residual and old and recent alluvial origin. Including rough stony land, 9 soil types of 6 series are mapped, of which the Dekalb silt loam and stony silt loam and the Upshur silty clay loam cover 36.8, 31.3, and 19 per cent of the area, respectively.

Investigations on different fertilization questions, O. LEMMERMANN (*Arb. Deut. Landw. Gesell., No. 297 (1919), pp. VIII+198*).—The results of a large number of different studies on fertilization questions in Germany are brought together in this report.

Eight years' experiments on the effect of fertilization with nitrogen, potash, phosphoric acid, and lime, with and without stable manure, on the yields of wheat, potatoes, beets, barley, and oats, and on the plant nutrient supplies of a slightly acid loamy sand soil, showed that in spite of the relatively low lime content of the soil, liming had no unusual effect on crop yields and in one case reduced the barley yield. In dry years smaller crops of grain were produced on limed and unmanured soils than on manured and unlimed soils.

Potash on the whole gave only relatively small returns. In the majority of cases phosphoric acid fertilization resulted in decreased crop yields whether stable manure was added or not.

Nitrogen fertilization generally increased crop yields with the exception of potatoes, but its beneficial effect was found to be more certain on winter grain than on summer grain. As a whole the yields in these experiments were higher where stable manure was used than where it was omitted. It was found that treatment with ordinary commercial nitrogenous fertilizers is not sufficient to maintain the nitrogen supply in this soil.

The balance of phosphoric acid was always positive whether the soil was treated with commercial phosphatic fertilizers alone or stable manure alone. The potash balance was negative in all cases whether stable manure was used with potassic fertilizers or not, indicating the necessity for special attention to this feature.

A series of green manuring studies showed that the use of stable manure with green manure produced greater yields than when green manure was used alone. This attributed merely to the added effect of the stable manure. The use of straw was without apparent effect. Green manuring in the spring produced larger crop yields than fall green manuring. The plowing under of green manure to depths of from 25 to 28 cm. (10 to 11 in.) gave better results than plowing it under to a depth of only 20 cm. Nitrogen in the form of green manure was 45 per cent as effective for beets as nitrogen in the form of sodium nitrate, and was about twice as effective as that in stable manure. The above

ground parts of green manure crops were more effective as manure than the roots. Inoculation of the soil for legumes gave no noteworthy results.

In view of the above results a third series of studies on the influence of organic substances on the nitrogen in fertilizers and soil was conducted, and is to be continued.

A fourth series consisted of pot, cylinder, and field studies of different nitrogenous fertilizers. In a comparison of sodium nitrate, ammonium sulphate, lime nitrogen, and ammonium nitrate the best results with oats were obtained with ammonium nitrate, followed closely by lime nitrogen, while the poorest results were produced by ammonium sulphate. Ammonium nitrate again gave the best results with potatoes, followed by sodium nitrate, and lime nitrogen gave the poorest results.

Comparative field tests on a poor, light sand soil of sodium nitrate, ammonium sulphate, lime nitrogen, nitrogen lime, ammonium nitrate, calcium nitrate, and liquid manure showed that sodium nitrate plus lime produced the best results with oats, while ammonium sulphate, calcium nitrate, and liquid manure each gave better results than sodium nitrate alone. A threefold application of ammonium sulphate produced the largest total yields. About the same results were obtained with potatoes, except that calcium nitrate did not give as good results as sodium nitrate. Both the lime nitrogen and nitrogen lime gave good results with oats, and the latter gave good results with potatoes.

A summary of field experiments in a number of German provinces to compare sodium nitrate, ammonium sulphate, and lime nitrogen showed that an addition of 30 kg. of nitrogen per hectare (26.7 lbs. per acre) to loamy sand soil in general produced good results with different crops. Sodium nitrate gave the highest yields in the majority of cases. Lime nitrogen failed only on very light sand soil.

Further experiments established the fertilizing value of urea, urea nitrate, urea calcium nitrate, potash ammonium nitrate, and ammonium chlorid. Urea nitrate, urea, and ammonium chlorid were especially beneficial to grain crops. No catalytic action of iron oxid was found on the fertilizing influence of lime nitrogen, and the addition of common salt to lime nitrogen and ammonium sulphate was also without effect.

Seven years' cylinder experiments with sodium nitrate, ammonium sulphate, and lime nitrogen showed that on different soils and under different conditions these three fertilizers will have a very variable relative effect upon the same crop. The addition of lime with the three fertilizers was attended by favorable results. The injurious action of an excess of ammonium sulphate on different crops was completely nullified by adding common salt.

Pot experiments showed that lime nitrogen, while less effective than sodium nitrate, is an active nitrogenous fertilizer when applied properly and at the right time. It injured crops when applied as a top-dressing, and was easily leached out in undecomposed form by adding an excess of water. It gave as good results when applied 3 days before seeding of crops as 12 days.

Pot experiments with oats confirmed the good results obtained in field experiments with some of the new nitrogenous fertilizers, such as ammonium bicarbonate, ammonium sodium sulphate, ammonium chlorid, urea nitrate, and urea when compared with sodium nitrate. Pot experiments also demonstrated the injurious action of granulated lime nitrogen to oats. It was found that dicyandiamid is a very undesirable constituent of lime nitrogen, and it is concluded that lime nitrogen to be acceptable as a fertilizer should have at least 70 per cent of its nitrogen content in the form of calcium cyanamid. Ammonification tests of dicyandiamid salts, including dicyandiamidin sulphate and nitrate,

showed that these salts were decomposed by bacteria with difficulty, while lime nitrogen and cyanamid calcium carbonate yielded noteworthy amounts of nitrogen. However, the latter fertilizer gave poor results with barley as compared to lime nitrogen.

Studies of the influence of additions of Thomas meal and superphosphate on a neutral soil which did not react to phosphorus showed that where no nitrogen was added better results were obtained with the Thomas meal, which is attributed to the action of lime in the Thomas meal in setting free the soil nitrogen. Neither phosphate exercised any appreciable influence on the action of sodium nitrate, although usually better yields were obtained on the Thomas meal treated soils. Ammonium sulphate on the other hand produced generally higher yields with Thomas meal, except where an excess of ammonium sulphate was applied.

Studies on the influence of time of application on the action of sodium nitrate, ammonium sulphate, and lime nitrogen showed that under all conditions the quality of results obtained with the different fertilizers decreased in the order named. For winter rye the best results were obtained where one-third of the nitrogen was applied in the fall and two-thirds in the spring. It was found to be always advisable to avoid using large quantities of soluble nitrogenous fertilizers on light soil in the fall. Sodium nitrate and lime nitrogen gave the best results with beets when applied before seeding, while with ammonium sulphate time of application apparently made little difference. Relatively late nitrogen fertilization gave good results with potatoes. Top-dressings of lime nitrogen were injurious to summer grains. Sodium nitrate and ammonium sulphate gave the best results with summer grains when applied before seeding or as early top-dressings.

An extensive series of experiments on phosphoric acid fertilization showed little difference in the final average results produced by Thomas meal and superphosphate. Where sodium nitrate was used with these fertilizers the yields were always greater than where ammonium sulphate was used.

Experiments on three slightly acid soils, two of them productive and one unproductive, showed that the best results were obtained on all three with superphosphate plus calcium carbonate. No relation was established between the citrate solubility of the phosphoric acid of these soils and their apparent phosphoric acid requirements. There was also no relation between the phosphoric acid content of the crops and the reaction of the soils toward phosphoric acid fertilization. In spite of the acid character of the soils the raw phosphates always produced smaller crops than the Thomas meal and superphosphates. The content of phosphoric acid soluble in 2 per cent citric acid solution in the different phosphatic fertilizers, particularly Thomas meal and the raw phosphates, did not give a true indication of their value as sources of phosphoric acid.

It was found that raw phosphates, such as Algerian phosphate, gave considerably poorer results than superphosphate when used with sodium nitrate. Bone meal also gave poorer results than superphosphate, while Wolter phosphate gave approximately the same results. There was no difference between the action of steamed and ground Thomas meal. The action of raw phosphates was considerably improved by the supplementary use of ammonium sulphate or ammonium nitrate, but this favorable effect was nullified by liming. There was no indication that legumes utilize raw phosphates better than cereals.

Seven years' studies of potash fertilization showed that there was considerable variation in the response of different crops to potash applications. Potatoes and summer barley were especially benefited by potash applications,

while rather indifferent results were obtained with such crops as wheat, rye, and beans. Spring applications of potash usually gave better results than fall applications. There was little difference in the results produced by 40 per cent potash salts and kainit. The utilization of the potash in different fertilizers varied under different conditions within wide limits. The potash content of crops was almost always increased by potash applications whether the crop was increased or not. It is therefore concluded that the potash content of crops is not a safe indication of the potash requirements of soils.

A number of liming experiments on a slightly acid soil showed that in spite of its acidity the soil did not react to liming. Relatively large applications of caustic lime had no injurious action and the so-called hydraulic lime had no bad effects.

A large amount of tabulated data is appended.

Soil studies.—I, The influence of fertilizers upon the productiveness of several types of soil.—II, The influence of fertilizers and plant growth upon soil solubles, W. H. JORDAN (*New York State Sta. Bul. 473* (*1920*), *pp.* 27).—Studies on the influence of peat, stable manure, and commercial fertilizers in varying proportions on the productiveness of nine soils from different localities in New York showed that with commercial fertilizers the production was much larger than with stable manure containing the same amounts of nitrogen, phosphorus, and potassium. The yields of dry substance increased with increasing application of fertilizers, but not in the same proportion. On four soils the application of lime with stable manure produced greater increases than stable manure alone, on three soils an advantage was manifest, and on two soils the use of lime apparently caused injury.

The use of commercial fertilizers in different amounts and combinations on an unproductive soil resulted in the production of larger crops than the similar treatment of a productive soil. There was an increase in the production of dry substance with the increased use of fertilizers, but not a proportionate one. Nitrogen was the only ingredient of the commercial fertilizers which had any marked influence upon the growth of barley on these soils. Under forcing house conditions sufficient quantities of phosphorus and potassium were apparently supplied by the soils to support luxuriant crop growth.

Further studies on the influence of commercial fertilizers and plant growth on the water-soluble material in these eleven soils showed that when soluble commercial fertilizers were added to soils not supporting plant growth the amount of water-soluble nitrogen and potassium compounds was greatly increased and was maintained at about the same level for several months. After the production of two crops the amounts of water-soluble materials in the nine soils of the first experiments were greatly decreased. Plant growth, even in the earlier stages, also caused a marked decrease in water-soluble material to a certain level in the productive and unproductive soils. These results are considered to agree with a former conclusion that there is a proportion of water-soluble material maintained in the soil at nearly a constant level, irrespective of the growth of vegetation.

It is further concluded that the data have a significant bearing on the importance of the solubility of the essential ingredients of fertilizers, especially in the production of quickly growing crops.

Some observations on soil fertility and crop production, J. D. LUCKETT (*New York State Sta. Bul. 473, pop. ed.,* (*1920*), *pp. 18, fig. 1*).—This is a brief review and summary of the following bulletins of the station: Nos. 358 (E. S. R., 28, p. 816), 360 (E. S. R., 29, p. 22), 424 (E. S. R., 36, p. 510), 465 (E. S. R., 42, p. 326), and 473, noted above.

Soil fertility and soil management experiments, C. G. Selvig (*Minnesota Sta., Rpt. Crookston Substa., 1919, pp. 20–24*).—The yields so far obtained from different crop rotation and fertilizer experiments are reported, no conclusion being drawn as to best practice. Experiments on the fertilizing value of straw have shown little effect from either straw or straw ash.

Fertilizer experiments, P. E. Miller (*Minnesota Sta., Rpt. Morris Substa., 1919, pp. 8–20*).—The results of six years' rotation experiments with rock and acid phosphates and farm manures, using a rotation of corn, wheat, oats, and clover, are reported. All fertilizers except rock phosphate were applied after clover and preceding the corn crop. The rotation also included timothy and barley in some years.

It was found that acid phosphate gave the most profitable returns with wheat, clover, and barley, and that barnyard manure was equally effective or more so with corn and oats. A combination of acid phosphate and manure did not increase the yield of wheat any more than acid phosphate alone and only slightly more than manure alone. The combination of acid phosphate and manure and manure alone gave much better results with corn than acid phosphate alone. The returns from the use of rock phosphate are said to be gradually increasing.

Fertilizer tests with alfalfa showed that over a 3-year period acid phosphate produced an increase of a little more than half a ton of hay, while the increases with other fertilizers were too small to warrant their use. It was also found that the average brown silt loam soil of western Minnesota contains abundant lime in a form available to alfalfa.

The plowing under of 1 ton per acre of corn stover and wheat straw was found to be very beneficial to corn and, to a less extent, wheat.

Data on wheat and clover yields with different applications of acid phosphate and on corn, wheat, and barley yields with different applications of manure are also included.

An outline of a soil fertility program for Arkansas, B. Knapp et al. (*Ark. Agr. Col. Ext. Circ. 94 (1920), pp. 4*).—A very brief outline of a fertility program to be practiced on Arkansas soils is given.

Plant food, A. K. Short (*Tex. Agr. Col. Ext. Bul. C–11 (1920), pp. 7*).—A brief discussion of the important factors in soil fertility is given.

The continuous growing of wheat and rye with and without a legume as green manure, 1918, J. G. Lipman and A. W. Blair (*New Jersey Stas. Rpt. 1919, pp. 346–348*).—In a continuation of studies previously noted (E. S. R., 41, p. 19), it was found in 1918 that in the case of both wheat and rye the legume plat yielded an increase of a little more than 3 bu. per acre over the nonlegume plat and more straw. More nitrogen was also recovered in the dry matter from the legume plats.

The influence of bacteria carried in manure on the decomposition of green manures (legume and nonlegume), J. G. Lipman and A. W. Blair (*New Jersey Stas. Rpt. 1919, pp. 349–351*).—Continuing work previously noted (E. S. R., 42, p. 826), it was found that in 1918 the differences in the yields from the legume and nonlegume sections were only slight, due to the failure of the legume cover crop. The manure appeared to have little effect on the legume plats. The percentage of nitrogen in the grain from the manured plats increased slightly, but the increases were not in proportion to the amounts of manure applied. It is concluded that these increases are not necessarily due to the nutritive constituents of the manure, but possibly to the activity of the organisms introduced with the manure.

Sewage investigation, J. W. Thomson (*New Jersey Stas. Rpt. 1919, pp. 445–447*).—An outline is given of the proposed study of the chemistry and biology

of sprinkling sewage filters and of the availability of the end products for fertilizers.

The influence of the mechanical composition of the soil on the availability of nitrate of soda and dried blood, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt. 1919, pp. 333–346, figs. 3*).—The results for the year 1918 of a series of cylinder experiments begun in 1911 are reported, confirming the progress results reported in 1917 (E. S. R., 41, p. 22).

For all soil combinations the yield of barley was greater with sodium nitrate than with dried blood, but for pure sand the opposite was true. The average recovery of nitrogen from sodium nitrate was 53.9 per cent and from dried blood 33.97 per cent, thus indicating the availability of the blood to be 63 per cent of that of the sodium nitrate. Dried blood gave the highest average yield with the residual crop, but the combined results of the two crops showed that the average yield of nitrogen was greater for the nitrate cylinders than for the dried blood cylinders, and the average recovery nearly 10 per cent greater.

The importance of salt petrography in potash mining, F. VON WOLFF (*Jahrb. Halleschen Verband. Erforsch. Mitteldeutsch. Bodenschätze, No. 1 (1919), pp. 15–21, fig. 1*).—The petrography of the German potash deposits is discussed.

It is shown that data on the petrography of the salt deposits serve to indicate the mineralogical composition of the natural salt profile, and with the aid of the theoretical knowledge of transformation processes indicate those transformations undergone by the deposits. This information is considered to be of great practical value, since the potash miner must know whether valuable leachings have been removed and where they have gone. An exact knowledge of the contents of the salt deposits should also be of practical importance in this connection.

Average analyses of fertilizing materials (*New Jersey Stas. Rpt. 1919, pp. 38–43*).—Average analyses of a large number of samples of different fertilizer materials published from time to time in bulletins of the stations, are here tabulated.

AGRICULTURAL BOTANY.

An apparatus for automatically changing the temperature of a chamber, G. F. POTTER (*Amer. Jour. Bot., 7 (1920), No. 1, pp. 39–43, pls. 2*).—The theory having been advanced that the injury produced in certain plant tissues by freezing is influenced considerably by the rate at which the temperature falls during the freezing process, the author has attempted to develop an apparatus in which the rate of temperature change is automatically controlled by clockwork in order to obtain a uniform and known rate of temperature fall for experiments of this sort. It is claimed that any desired rise or fall of temperature can be obtained with this apparatus, the conditions desired for a 10-hour period being determined and recorded in advance. By repeating the experiment without altering the adjustments, different lots of tissues may be frozen under duplicate temperature conditions.

It is stated that the use of this machine has enabled the author to perform freezing experiments under conditions controlled more accurately than has been possible even with the closest personal attention when using a hand-controlled freezer, the range and accuracy of regulation of temperature depending almost entirely upon the thermostat. The instrument employed by the author is said to work through a range of 10° C., the variations indicated between the temperature on the chart and that observed in the chamber usually being not greater than 0.1°, although variations of 0.25° may sometimes occur.

Formative effect of high and low temperatures upon growth of barley: A chemical correlation, H. L. Walster (*Bot. Gaz., 69 (1920), No. 2, pp. 97–126, figs. 18*).—This is a study of the effects of temperatures and variations thereof in connection with variations in the supply of nitrogen, phosphorus, and potassium, respectively, upon the course of development of the barley plant. It is claimed that a chemical correlation exists between temperature and nutrition effects.

Chemical and physical changes during geotropic response, T. G. Phillips (*Bot. Gaz., 69 (1920), No. 2, pp. 168–178*).—This work as here described is said to show that definite moisture changes occur during geotropic bending in corn nodes. The greater percentage of moisture occurs in the concave flank during the period of bending, but afterwards in the convex flank. The data show no correlation between the geotropic bending of etiolated shoots of *Vicia faba* and differences in moisture, titration acidity, hydrogen-ion concentration, catalase activity, or the distribution of sugars and nitrogen-containing substances.

The upward translocation of foods in woody plants.—I, Tissues concerned in translocation, O. F. Curtis (*Amer. Jour. Bot., 7 (1920), No. 3, pp. 101–124, figs. 4*).—In order to determine more definitely whether the upward translocation of food takes place through the phloem or the xylem, the author has conducted a series of experiments which are partly reported in this paper.

It is stated that growth ceases in defoliated stems from which a ring of tissue extending to the cambium has been removed. Such cessation is thought to be due to the inability of the xylem to carry the food (particularly carbohydrates) which is needed to supply energy and building material and also to increase the osmotic concentration of the tissues to permit adequate water absorption. If the stem above a ring is not defoliated, the leaves are able to supply sufficient food to permit considerable growth.

When dormant stems are ringed, growth above the rings ceases soon after the starch supply has been depleted. Carbohydrates stored in the xylem below the ring can not be removed through the xylem but must be transferred radially to the phloem, where they may be carried downward if there is no second ring below. The carbohydrates of the xylem between two rings remain there for at least some time after those above the upper ring and those below the lower ring have been mostly removed. Although large amounts of carbohydrates are stored in xylem tissues, there is no appreciable longitudinal transfer of sugars through these tissues.

Physiological study of maple seeds, H. A. Jones (*Bot. Gaz., 69 (1920), No. 2, pp. 127–152, figs. 2*).—The seeds of the sugar maple (*Acer saccharum*) and river maple (*A. saccharinum*) showed some striking contrasts, here detailed, as regards season of maturity, reaction to external conditions, chemical composition, and phases of physiological behavior in general.

A method of studying the absorption-transpiration ratio in nutrient media, E. S. Johnston (*Science, n. ser., 52 (1920), No. 1352, pp. 517, 518*).—Tomato plants grown with their roots immersed successively in a three-salt nutrient solution of 1.75 atmospheres osmotic pressure, cane sugar solution of 5.06 atmospheres osmotic pressure, and distilled water showed that when the hourly rate of absorption is in excess of transpiration the ratio of absorption to transpiration is greater than unity and the plant cells increase in turgor. When this ratio is less than unity, turgor is decreased, and if the process is continued long enough the cells become flaccid and the plant is seen to wilt.

In the experiments reported the plants gained in turgor during the first two periods, but during the third and fourth periods the ratio values decreased very much. This decrease is considered mainly due to lower absorption rates, since the roots were surrounded by a solution much stronger during these two periods than during the first two. The rates of absorption of the last two periods were greatly increased by placing the roots in distilled water.

On the relationship between freezing point lowering and specific electrical conductivity of plant tissue fluids, J. A. Harris, R. A. Gortner, and J. V. Lawrence (*Science, n. ser., 52 (1920), No. 1351, pp. 494, 495*).—In a study of a series of 19 species of trees, 36 species of shrubs, and 162 species of herbs grown on the glacial moraines of Long Island, there was found to be practically no relationship between the concentration of ionized electrolytes and of total solutes in the leaf tissue fluids.

The effect of conditions on the relation of seed plants to H-ion concentration of nutrient solutions, B. M. Duggar (*Abs. in Science, n. ser., 52 (1920), No. 1348, p. 416*).—The author claims that the hydrogen-ion concentrations of carefully prepared and analytically pure monobasic phosphates are for some plants near or above the critical point for growth maintenance. The effects of changes in the environment, especially temperature and humidity, affect the response of the plants to changes in hydrogen-ion concentrations. The optimum pH, like the optimum temperature, may be represented by a considerable range of values that may be defined closely only in relation to other environmental conditions.

Optimum nutrient solutions for plants, D. R. Hoagland (*Science, n. ser., 52 (1920), No. 1354, pp. 562–564*).—In previous publications (E. S. R., 40, p. 817; 42, p. 24) the author showed that in many experiments the total supply of the nutrients rather than the salt proportions may have limited the yield of crop. The question has been raised as to whether it is probable that the plant has any definite response within broad limits to a particular ratio of salts or ions contained in the complete nutrient solution. To determine this fact he has conducted investigations using 3 series of nutrient solutions which differed radically in concentration and salt proportions. In each case 15 barley plants were grown for six weeks and the composition of the air-dried plants determined at the end of the period.

The author states that he does not wish to give the impression that certain solutions may not inhibit plant growth on account of unfavorable physiological balance, but he desires to point out that the range of equally favorable ratios between nutrient salts is probably a very broad one, no doubt including the solutions of most soils.

The influence of the moisture content of sand cultures upon the physiological salt balance for plants, J. W. Shive (*New Jersey Stas. Rpt. 1919, pp. 358–363*).—The results are given of an investigation on the influence of the moisture of a solid substratum upon the physiological salt balance as it affects the growth of plants. The experiments were carried on with spring wheat, the plants being grown for 28 days in white seashore sand which was thoroughly washed with tap water and afterwards several times with distilled water. The nutrient solutions which were added to the sand comprised a series of all the possible sets of salt proportions of the three salts monobasic potassium phosphate, calcium nitrate, and magnesium sulphate, when the increment by which the salts were made to vary was always equal to one-tenth of the total osmotic concentration.

Three series of sand cultures were run in which the solutions were added to bring the moisture content up to 40, 60, and 80 per cent of the water-retain-

ing capacity of the sand. The average dry weights of the nine highest-yielding crops were taken, and the results showed that the yields of both tops and roots in the series containing a medium moisture content were always considerably higher than corresponding values where a lower and a higher moisture content, respectively, were employed. This is held to indicate that well-balanced nutrient solutions with optimal total concentrations for plant growth are not alone sufficient to produce the best yields of which the solutions are capable, when these are diffused as films over the particles of a solid medium, such as sand, and in quantities greatly in excess of the requirements of the plants. It is believed that the actual plant production power of any given set of salt proportions or of any fertilizer treatment is largely determined by the moisture conditions of the substratum.

The influence of sand of different degrees of fineness upon the concentration and reaction of a nutrient solution, J. W. Shive (*New Jersey Stas. Rpt. 1919, pp. 363–366*).—In order to determine whether solid substances of certain characters presenting large surfaces have the power of removing salts from solution by concentrating the solute at the surface of the solid material, the author carried on some experiments with coarse, medium, and fine sand, which was thoroughly washed and afterwards received a nutrient three-salt solution. The cultures were allowed to stand for 24 hours, after which as much as possible of the solution was extracted and tested for the lowering of the freezing point and for the hydrogen-ion concentration. The sand of each culture was then flooded with a new solution and allowed to stand for 3, 5, and 10 days.

As a result of the investigation, it is claimed that sand of different degrees of fineness, such as was employed, when washed free from colloidal or semicolloidal material, does not markedly alter either the reaction or the total concentration of the nutrient solution in contact with the solid sand particles, under the experimental conditions ordinarily experienced in sand culture work.

The relation of salt proportions to the growth of wheat in sand cultures, E. Van Alstine (*New Jersey Stas. Rpt. 1919, pp. 366–374, figs. 2*).—A report is given of culture experiments with a nutrient solution composed of monobasic potassium phosphate, calcium nitrate, and magnesium sulphate, the object of the investigation being to obtain additional information on the question of the proportions of salts in a three-salt solution which will give the best growth of plants. Wheat plants were used in this investigation, and the molecular concentrations of the different solutions were varied by the use of a large number of combinations of the different salts. The yields of tops and roots, the total transpiration, and the water requirements of tops and roots for dry substance were determined.

In general, it was found that the number of tillers per culture had some relation to the yield, high yield corresponding to the largest number of tillers and low yield to the lowest number. High transpirational water loss was found correlated with high yields of tops and roots and low transpiration with low yields. In determining the water requirements it was found that high yields of tops were correlated with low water requirements, and low yields corresponded to high water requirements. This same relation was found to hold between water requirements and root yields.

In order to determine the effect of the plants on the reaction of solutions in which they were grown, hydrogen-ion concentration determinations were made of the original solutions and also of the solutions at the end of each growth interval between two successive solution renewals throughout the entire growth period of five weeks. It was found that the reaction of the solution

was changed by the plants toward the neutral point during each interval and that the change in the reaction became more and more pronounced as the plants grew older. There is considered to be a limit to the extent of change in the reaction of the nutrient solutions toward the neutral point which plants in different stages of development can bring about. It appears also that the different solutions of the series respond differently to the influence of the plants with respect to change in the hydrogen-ion concentration.

Experiments to test effects of iron salts on corn plants, G. N. Hoffer and R. H. Carr (*Abs. in Phytopathology, 10 (1920), No. 1, p. 57*).—In order to test the capacity of the tissues of cornstalks to accumulate iron and other metallic base compounds, 0.5 per cent, 1 per cent, and 2 per cent solutions of various iron, copper, and aluminum compounds were introduced in the stalks through punctures made in the internodal cortical tissues.

Ferrous sulphate solutions were active in affecting the nodal tissues. Catalase and oxidase actions were greatly increased and the tissues became brown and disintegrated, the leaves wilted and fired, and premature death of the stalks resulted. The effects of the treatments were similar to those observed in stalks affected by root rots.

The ferric salts of equal concentrations and quantities were either less effective or had no apparent effect whatever. In all cases ferric salts stimulated oxidase and catalase action, but not to the same degree as the ferrous sulphate solutions. Potassium sulphate solutions had no noticeable effect. Aluminum salts stimulated catalase and oxidase action, while copper sulphate was very toxic.

Check plants supplied with water or with nutritive salt solution in equivalent concentrations showed no harmful effects from the treatment.

The injection of chemicals into chestnut trees, C. Rumbold (*Amer. Jour. Bot., 7 (1920), No. 1, pp. 1-20, figs. 7*).—Experiments on tree injection were undertaken as a possible means of combating the chestnut bark disease. Orchard trees were used, for the most part Paragon scions grafted on native stock, *Castanea dentata*, aged 10 or 14 years.

Considerable capacity for absorbing chemicals, particularly in case of the more concentrated solutions, was shown by the trees. Solutions of organic compounds were taken up more readily than were solutions of inorganic compounds, and "true solutions" more readily than the colloidal. The effects of the injections here described are noted below.

Effect on chestnuts of substances injected into their trunks, C. Rumbold (*Amer. Jour. Bot., 7 (1920), No. 2, pp. 45-56, pls. 2*).—The observations here noted are based on tree injections made during the summers of 1912-1915 with orchard chestnuts (Paragon scions grafted on *Castanea dentata*).

In southeastern Pennsylvania, June was the best month for injection so far as rate of intake was concerned; then, in order, July, May, August, September, October, and April. The rate of intake depended upon local weather conditions, varying more in April, May, and June than in other months. The injected solutions as a rule passed through the vessels of the youngest annual ring of wood up and down the tree trunk in a zone the width of which was usually a little greater than that of the injection hole. They afterwards passed into the roots, branches, and leaves, and in case of the lithium salts into the nuts.

Though colloidal and alkali metals and organic compounds were not detrimental to the trees, heavy metals were injurious. Water extract of chestnut blight canker was detrimental, but not healthy bark extract.

The effect on the tree varied with the dilution of the solution and with the month in which the injection was made. Some of the bases produced charac-

teristic leaf discolorations. The visible effect of a solution on a tree usually varied with the distance from the point of injection. The injections may cause the appearance of pathological xylem in the tree trunks. Dilute solutions of lithium salts injected in the spring months may have an effect on the chestnut blight fungus in that the growth of the cankers on the injected trees appeared to be checked somewhat and the trees showed a tendency to form a callus about the canker.

The work is regarded as incomplete, and inconclusive as regards results.

Chromosomal duplication and Mendelian phenomena in Datura mutants, A. F. BLAKESLEE, J. BELLING, and M. E. FARNHAM (*Science, n. ser., 52 (1920), No. 1347, pp. 388–390*).—The results are given of a study begun by the authors of the relationship which exists in Datura between the cytological condition and the related phenomena of mutation and Mendelian inheritance. As previously reported (E. S. R., 41, p. 634), 12 separate and distinct mutants of the jimson weed (*D. stramonium*) have been observed, and a further study of some of their characters is in progress.

Revisions of North American grasses: Isachne, Oplismenus, Echinochloa, and Chætochloa, A. S. HITCHCOCK (*U. S. Natl. Mus., Contrib. Natl. Herbarium, 22 (1920), pt. 3, pp. XII+115–208, pls 8, figs. 42*).—In continuation of his studies on North American grasses, the author presents the revisions of four genera of the tribe Paniceæ.

The leguminous plants of Hawaii, J. F. ROCK (*Hawaii Sugar Planters' Sta. [Pamphlet], 1920, pp. X+234, figs. 93*).—Descriptions and economic notes are given of 71 genera and 200 species of native, introduced, and naturalized trees, shrubs, vines, and herbs, belonging to the family Leguminosæ.

FIELD CROPS.

Report of [field crops] work at Fairbanks Station, C. C. GEORGESON, M. D. SNODGRASS, and W. T. WHITE (*Alaska Stas. Rpt. 1918, pp. 13, 14, 57–69, pls. 2*).—This describes the continuation of work during 1918 along the same general lines as previously noted (E. S. R., 41, p. 29). The winter of 1917–18 was regarded as the coldest known in the Tanana Valley, with nearly double the amount of normal snowfall, and the season of 1918 was considered the least favorable for crop production since the station was organized. The frost-free period was about 57 days.

Winter rye winterkilled badly and made a low yield of inferior grain. The work with spring grains included variety tests of oats and barley, increase and field plats of wheat, oats, and barley, selection work with the preceding crops and rye, and comparative tests of oats and barley for hay. Brief notes on the results secured are presented.

Grain crops following grain of the previous season matured earlier, with shorter straw growth and smaller grain yields than when following cultivated crops. Canadian oats yielded 47 bu. per acre on clover sod as compared with 26 bu. on wheat land, but rank growth, tendency to lodging, and late maturity were noticeable on the clover sod. Among the oat varieties, South Dakota and Sixty-Day matured in 92 and 91 days and made respective acre yields of 49.5 and 48.2 bu. Hull-less and beardless barley, both maturing in 90 days, averaged about 29 bu. per acre. A barley hybrid, Rampart 28a, and an oat hybrid, Rampart 35e, have shown superior merits, growing rapidly with marked early maturity. Canadian and South Dakota oats seeded for hay were fully headed and fairly well filled by August 26. Barley headed early but seemed to require longer to fill than did the earlier oats.

The potato crop in the region was said to be the lightest in years. A late spring, together with late and early frosts, is held to be the cause of low yields. Late maturing varieties were badly damaged, yielding in many cases but little more than the seed planted. Only about one-half of the entire crop of the Tanana Valley, 550 tons, was marketable. Potatoes planted on south slopes had vines several inches higher, and tubers in larger numbers and with better growth than those planted on north slopes. Vines of alternate rows were cut off after frost and the potatoes dug separately, weighed, and graded. Cutting the vines reduced the grade as well as the yield of tubers in nearly every variety so treated. The yield increase with retained tops ranged from 9 to 28 bu. per acre. The Early Market, with an acre yield of 92.6 bu. of 70 per cent marketable potatoes, was first in the variety test.

Canada field peas produced a good crop of hay but matured few peas. Alfalfa winterkilled badly, suffered much damage from late freezes, and made but slow growth, maturing no seed. North Swedish and Semipalatinsk alfalfa manifested hardiness and fair adaptability to the region. Red clover seeded for green manure made a vigorous growth, about one-fifth of the plants blooming.

Volunteer Petrowski turnips persisted in spite of disking, harrowing, and subsequent seeding to carrots, and produced fair yields. Two varieties of stock carrots produced excellent yields on well manured garden land, but the short season prevented a good crop under field conditions. Although sugar beets gave unsatisfactory results on unfertilized field plats, neighboring sandy loam river land produced successful yields of roots of fair size and quality.

Cooperative tests of cereals and potatoes with farmers in the region were continued. Siberian H. G. wheat produced good crops, yielding about 18 bu. per acre.

Report of [field crops] work at Kodiak Live Stock and Breeding Station, H. E. PRATT (*Alaska Stas. Rpt. 1918, pp. 86–89*).—The continuation of work during 1917 conducted along the same general lines as previously noted (E. S. R., 41, p. 30) is described. The year was characterized by a late spring and late fall with a growing season almost normal in length. Cereals tested for hay production included Banner oats, Petkuser rye, and three varieties of barley. Red clover and alfalfa did not survive the winter, and two varieties of Canada field peas failed to set seed. Tussock grass from the Falkland Islands, vetch, and sunflowers all produced negative results.

Of 12 potato varieties tested, Burpee Superior, Irish Cobbler, and Gold Coin were the leaders.

Over 90 per cent of the silage put up at the station is ordinarily composed of beach grass (*Elymus mollis*) and tall beach sedge (*Carex cryptocarpa*). Native bluetop (*Calamagrostis langsdorfii*) forms over 90 per cent of the upland hay put up on Kodiak Island. This grass is occasionally supplemented by beach grass, which is said to make excellent hay when properly cured.

Report of [field crops] work at Matanuska Station, C. C. GEORGESON and F. E. RADER (*Alaska Stas. Rpt. 1918, pp. 16–19, 73–80, 81–83, pl. 1*).—Although characterized by a rather late spring following an uncommonly severe winter, and irregular rainfall, the season of 1918 was fairly favorable to crop production. A frost-free period of 141 days was recorded.

Marquis wheat ripened in 136 days but did not shatter like earlier maturing varieties. Romanow and Siberian H. G. wheat ripened in 125 and 102 days with respective approximate yields of 20 and 15 bu. per acre. Beardless and hull-less barley matured in 105 and 99 days, yielding 30 and 20 bu. per acre, respectively. Finnish Black oats produced about 30 bu. per acre in from 107

to 110 days. Spelt did not evidently merit comparison with the barleys, and rough buckwheat was deemed inferior to common buckwheat.

Oats seeded for hay made an estimated yield of 18 tons on 10 acres. Field peas gave fair results, but sweet corn was not found to be adapted to the climate. Sugar beets yielded about 7 tons of roots per acre, with sugar content ranging from 14.6 to 16.9 per cent. Trials of root crops showed rutabagas and Petrowski turnips to do well, but results with mangel-wurzels and carrots were negative.

Early John, Rusty Coat, and Matanuska were best among potato varieties, the last named bearing at the rate of 333 bu. per acre.

Cooperative cereal tests with settlers in the region were conducted as heretofore and seed of several varieties of grain distributed. Experiments by the farmers have indicated the possibilities of successful grain production, and improved thrashing methods and larger clearings are expected to extend the culture of grain in the region.

Report of [field crops] work at Rampart Station, C. C. GEORGESON and G. W. GASSER (*Alaska Stas. Rpt. 1918, pp. 11–13, 33–47, 48, 49, 51, pl. 1*).—This reports work with field crops conducted in 1918 in continuation of that previously noted (E. S. R., 41, p. 81). The season is described as being very unfavorable, cool dry weather in conjunction with the late spring proving a serious handicap to all crops and not overcome by more favorable conditions later in the season. The frost-free period was 94 days, 3 days less than the 10-year average.

Medicago falcata, the only one of several varieties and strains of alfalfa to prove entirely winter resistant, ripened considerable seed, especially in the lower parts of the plats. Grimm alfalfa, seeded in 1914, froze out completely, variant selections winterkilling as did the standard purple-flowered plants. A large number of 2-year-old reciprocal crosses of Grimm and *M. falcata* made fair growth, notwithstanding the fact that many froze out the preceding winter.

Although roots of *Vicia cracca* were alive after the winter only an occasional shoot was to be seen by the middle of June. Many live shoots present under the surface appeared ready to grow but apparently lacked the vitality to do so. *Trifolium lupinaster* suffered considerable winter injury for the first time, producing but little seed and poor growth. Peas made irregular growth, failing completely on the drier portion of the fields.

Variety tests and hybridization work with winter wheat and rye, and spring wheat, rye, barley, and oats are noted as heretofore, and the results secured with each outlined. It is noted that a number of winter wheat varieties froze out during the winter in spite of previous cold resistance.

Hemp produced a short spindling growth, blooming about 44 days after planting. Flax grew normally, reaching a height of 24 in. and maturing about 10 per cent. of the seed.

Potatoes grown in cribs with a productive capacity equal to a row 150 ft. in length with hills 14 in. apart yielded but 71 lbs., or 0.55 lb. per hill. It is stated that in the garden the same number of hills would have yielded 250 lbs. of better quality and with less labor. Irish Cobbler led Early Six Weeks and Burpee Superior in quality, the three varieties making respective yields of 2.1, 2.8, and 2 lbs. per hill.

In a test for sugar content, the juice of 18 lbs. of sugar beets yielded 3 lbs. of black but very sweet and palatable sirup of the consistency of commercial corn sirup. With an estimated yield of 10 tons of roots per acre it is thought that but one-tenth acre would be required to produce a barrel of sirup, indicating a valuable source in event of sugar scarcity.

[Work with potatoes at the Sitka Station], C. C. Georgeson and C. H. Benson (*Alaska Stas. Rpt. 1918, p. 24*).—This describes the progress of work along the same lines as previously noted (E. S. R., 41, p. 38). Of over 900 seedlings grown from seed balls, only about one-tenth gave promise and were retained for further trial. Seedlings of three Norwegian introductions were considered valuable on account of good yielding ability and superior quality. It is stated that while many of the best cultivated varieties from the States grow to large size and give good yields in Alaska, they often become soft and soggy and undesirable for table use.

[Report of field crops work at the Crookston Substation, Minn., 1919], C. G. Selvig (*Minnesota Sta., Rpt. Crookston Substa., 1919, pp. 9–19, 28, 29*).—Descriptions are given of variety, culture, and fertilizer tests with various crops in continuation of similar work already reported (E. S. R., 42, p. 824).

The leading varieties and their 1919 acre yields were as follows: Emmer 38.1 bu., Mindum wheat 24.4 bu., Minsturdi barley 34 bu., beardless barley 33.7 bu., Minnesota No. 177 flax 16.4 bu., Golden vine field peas 12.9 bu., Northwestern Dent corn 79.9 bu., Dakota White Flint corn 66.9 bu., and Disco 38 alfalfa 11,066 lbs. Barley and oat variety and cultural plats suffered such flood damage that results were largely negative.

A seeding test with wheat showed a ratio of 5 pecks per acre to give the highest yield averaging 27.1 bu. per acre.

In rotations conducted from 1912 to 1919, inclusive, average acre yields were as follows: Wheat in 3, 5, and 7-year rotations 21.3, 21.2, and 21 bu., respectively; wheat grown continuously 16.4 bu.; wheat grown continuously with 6 lbs. clover 13.8 bu.; oats 5-year rotation 44.3 bu.; oats 7-year rotation 53.8 bu.; barley 7-year rotation 33.9 bu.; and flax 7-year rotation 15.4 bu.

Rain and flood prevented uniform conditions in many of the potato experiments, rendering breeding work and fertilizer tests of negligible value. It was noted that late varieties withstood summer floods better than the early sorts. Large seed pieces and whole seed resisted flood as well as drought better than small seed pieces. Bin-selected seed withstood adverse conditions better than field-run and run-out seed. Seed treated with corrosive sublimate before cutting and after cutting yielded 117.3 and 74 bu. per acre, respectively. Plats from seed infected with black scurf treated with corrosive sublimate gave from 88 to 93 per cent clean stock. Seed treated with formaldehyde produced from 75 to 81 per cent clean seed and no-treatment plats but 48 per cent.

Small whole (2 oz.), medium-sized whole (4 oz.), and large whole (8.8 oz.) potatoes yielded 208.2. 232, and 226.6 bu. per acre, respectively, and the average weight of tubers produced was 5.14, 4.78, and 4.5 oz. The heaviest tubers were produced on "single-eye" plats, where 1-oz. seed pieces yielded tubers averaging 5.2 oz. in weight.

[Report of field crops work at the Morris, Minn., Substation, 1919], P. E. Miller (*Minnesota Sta., Rpt. Morris Substa., 1919, pp. 20–40, figs. 3*).—The continuation of work previously noted (E. S. R., 42, p. 731), including variety and cultural tests with cereals, legumes, and potatoes, and various rotations with grain and hay crops, is reported.

The highest yielding varieties of crops tested during 1919 were as follows: Mindum durum wheat 20.9 bu., Marquis wheat 17.9 bu., Minnesota No. 1507, a hybrid winter wheat, 11.4 bu., Kherson oats 39.1 bu., Minsturdi, a six-rowed barley, 34.3 bu., Minnesota No. 2 rye 23.4 bu., M. A. C. Robust field beans 19.4 bu., Soysota soy beans 29 bu., Rustler white dent corn 52.4 bu., Dakota white flint corn 38.7 bu., Early Ohio potatoes 64.6 bu., and Rural New Yorker late potatoes 88.5 bu. Besides showing the best winter resistance in 1918–19, Grimm and Turkestan alfalfa showed the highest yield for 1919.

In rate of seeding tests with winter rye, the highest average grain yields were secured from the use of 70 lbs. per acre, and in date of seeding tests, when seeded on September 10. With winter wheat, the use of 90 lbs. sown on either September 3 or September 10 produced the highest yields, about 10 bu. of grain per acre.

Selection work with Minnesota No. 13 corn has so developed the strain that it will mature in about 110 days and produce an average acre yield of 50 bu. of air-dried corn.

Potatoes sprayed with Bordeaux mixture for early blight (*Alternaria solani*) produced an average of 105.2 bu. per acre and those untreated 93.9 bu. Spraying resulted in a higher yield of larger and more mature potatoes. Level cultivation produced an average of 94.2 bu. of potatoes per acre as compared with 89.1 bu. from ridged cultivation, indicating that level surface culture is best, at least in dry seasons. In a depth of planting test with potatoes, plantings 3 in. deep produced the highest yield, 2 in. deep second, 4 in. deep third, and 5 in. deep last.

[Report of work with field crops in Montana] (*Montana Sta. Rpt. 1919, pp. 20–22, 35–39*).—The continuation of work similar to that previously noted (E. S. R., 40, p. 429) is described. The work conducted by the department of agronomy at Bozeman and the Fort Ellis farm and on the Moccasin, Huntley, and Havre Substations included variety tests of cereals, legumes, grasses, root crops, and miscellaneous forage crops; cultural experiments with flax, sunflowers, and peas; rotations; inheritance studies with oats; and selection work with sunflowers. In a time of planting test of corn conducted in cooperation with the U. S. Department of Agriculture, in which plantings of several varieties were made three weeks apart, no advantage accrued from early planting.

Results secured by P. V. Cardon at Judith Basin Substation during the driest season in its history are said to confirm experiences of previous years, emphasizing the importance of crop rotation on the dry land of central Montana. Wheat following fallow or intertilled crops yielded as high as 9 bu. per acre, while in many cases that following resulted in failure. Similar results were secured with oats, barley, and flax. The 11-year average yield of winter wheat slightly exceeded the 12-year average yield of spring wheat. Kharkov and Turkey led the winter varieties with average acre yields of about 25 bu. Outstanding varieties with average acre yields for a period of years include Pelissier, a durum spring wheat, 11 years, 23.7 bu.; Marquis, common wheat, 7 years, 22.7 bu.; Sixty Day and Swedish Select oats, 12 years, each about 50 bu.; White Smyrna and Hannchen barleys, 10 years, 41.1 and 39.7 bu., respectively; and N. D. No. 155 (C. I. No. 19) flax, 9 years, 13.5 bu.

The variegated group, such as Grimm and Baltic, is said to have given the best results of the alfalfa varieties tested. Although from a week to 10 days later white sweet clover yielded a higher acre-tonnage than the yellow type. Field peas averaged from 10 to 12 bu. per acre, and brome grass and *Agropyron cristatum* showed promise among the grasses.

Work at the Huntley Substation in cooperation with the U. S. Department of Agriculture was conducted by D. Hansen in continuation of that noted previously (E. S. R., 43, p. 435). A very dry season was experienced, a total of but 2.21 in. of rain falling in April, May, June, and July. Early irrigation was required to start the spring seeded irrigated crops, with consequent reduction of yields. The hot season, however, gave large yields of pasture, hay, and alfalfa, some of the alfalfa plats yielding about 6.75 tons per acre. Dry land crops were said to be almost total failures except on summer-fallowed land. The average acre yields on fallow were winter wheat 13.8 bu., spring wheat 6.8 bu., oats 4.1 bu., and barley 6 bu. The crops after corn were failures,

although in all previous years the grains grown after corn either equaled or exceeded those after fallow.

[Report of work with field crops in the Virgin Islands, 1919], L. SMITH (*Virgin Islands Sta. Rpt. 1919, pp. 7–10, 11, 12, 13, 14, pl. 1, figs. 3*).—This describes the continuation of work along the same general lines noted previously (E. S. R., 36, p. 332) as conducted by the station, then known as the Agricultural Experiment Station of St. Croix.

Sugar cane experiments included variety and fertilizer tests, trials of imported seed, and distribution of promising sorts. Cane S. C. 12/4 has given the best results in every test and is grown on the largest scale. It has yielded from 25 to 80 per cent more weight than Ribbon and with juice of 10 per cent greater sucrose content.

Cotton work was confined to tests of Sea Island varieties and selections. It is noted that nearly all of the cotton planted on the island is pedigree cotton selected by the station.

The ear-to-row method of corn improvement practiced by the station is said to have doubled the acre yield on the island. While Hickory King gave the best results of all new kinds, varieties from the United States did not approach acclimated sorts in yield.

Madagascar, Lyon, velvet, and Canavalia beans all gave good results for green manuring purposes, but Madagascar beans bore no seed because of a fungus attack. Black Venezuelan was best in seed production. Soils on St. Croix are not considered favorable to legume culture.

Guinea grass, Napier grass, and Barbados sour grass (*Andropogon pertusus*) show promise of considerable value on the island, while Sudan grass and Para grass (*Panicum barbinode*) are not deemed desirable.

Meadows for the Northern States, C. V. PIPER and L. CARRIER (*U. S. Dept. Agr., Farmers' Bul. 1170 (1920), pp. 13, fig. 1*).—This publication discusses permanent rotation and temporary meadows, suggests plant mixtures for meadows on various types and conditions of land, and indicates cultural methods and field practices considered desirable in establishing meadows. A list of the more important hay plants for the northeastern part of the United States, giving briefly their chief characteristics and uses, is included.

Alsike clover, A. J. PIETERS (*U. S. Dept. Agr., Farmers' Bul. 1151 (1920), pp. 25, figs. 8*).—This publication describes alsike clover, its adaptations, and uses, and discusses cultural practices employed in growing the crop for hay, in mixtures and as a companion crop, in pastures, meadows and sloughs, and on overflowed lands. Brief notes on crop pests and the uses of the crop for silage and soil improvement, are presented, together with suggestions for the production of seed.

Cowpeas: Utilization, W. J. MORSE (*U. S. Dept. Agr., Farmers' Bul. 1153 (1920), pp. 23, figs. 8*).—The use of cowpeas for human food, feeding purposes, hay, pasture, silage, soiling, and soil improvement is discussed in some detail, and improved methods of harvesting and handling the crop for seed production and for hay are described. Considerable data secured in experiments conducted by the State experiment stations and this Department, including germination tests, yields, and shelling percentages of the best varieties are presented, together with comparative analyses of cowpeas and other crops when used for hay.

Milo, a valuable grain crop, B. E. ROTHGEB (*U. S. Dept. Agr., Farmers' Bul. 1147 (1920), pp. 19, figs. 8*).—The publication describes milo, discusses its history, adaptation, varieties, and yielding ability, and indicates field practices and cultural methods employed in its production. Methods of storing the grain

and utilizing the crop are noted, together with brief accounts of diseases and insect enemies.

Experiments on the spacing of potato plants, F. C. STEWART (*New York State Sta. Bul. 474 (1920), pp. 3–32*).—Experiments to determine the feasibility of employing close planting in the production of seed potatoes as a means of improving the quality of the crop through a reduction in the average size of the tubers are described. These tests consisted chiefly of comparisons of 6 by 36 in. planting with 15 by 36 in. planting grown in alternate rows during five seasons. At harvest time, the product of each row was sorted, according to weight, into grades under 1 oz., from 1 to 2 oz., from 2 to 12 oz., and over 12 oz., and the tubers of each grade weighed and counted.

In different seasons, the total number of tubers over 1 oz. in weight varied from 41,847 to 62,600 per acre for thin planting, and from 71,603 to 97,150 per acre for thick planting. The difference in favor of thick planting ranged from 29,281 to 34,550 tubers per acre. In total quantity of tubers over 1 oz. in weight, the yield varied, in different seasons, from 144.5 to 340.8 bu. per acre for thin planting and from 191.8 to 384.4 bu. per acre for thick planting. The difference in net yield (total yield minus seed) of tubers over 1 oz. in weight varied from 24.9 to 46.6 bu. per acre, and averaged 34.7 bu. per acre, in favor of thick planting, over one-half of the difference (18.7 bu.) consisting of tubers over 2 oz. in weight. The average weight of tubers over 2 oz. in weight was found to be reduced from 10.5 to 22.8 per cent by thick planting. For table use, the size of the tubers of the crop from thick planting was considered superior to that from thin planting in 1914 and 1919, but in the other three seasons the tubers from thin planting were the better in this respect.

From the results of the experiment the author suggests that in the production of seed potatoes of varieties of the Rural group, New York growers may well consider planting considerably closer than 15 by 36 in., since thereby the net yield is likely to be increased and the quality of the crop improved, particularly on rich soil. In the home seed plat the spacing in the row should be as close as is consistent with roguing; but for market purposes the difficulty in disposing of the small tubers may necessitate somewhat thinner planting, except on rich soil. Potatoes grown in rich garden soil, for table use, may be planted as close as 6 by 30 in. with advantage.

Seed potatoes improved by close planting, J. D. LUCKETT (*New York State Sta. Bul. 474, pop. ed., (1920), pp. 3–6*).—This is a popular edition of the above.

Irrigation of potatoes, W. L. POWERS and W. W. JOHNSTON (*Oregon Sta. Bul. 173 (1920), pp. 28, figs. 9*).—Results of irrigation experiments with potatoes conducted from 1907 to 1919 in eastern and western Oregon are reported. The work included time, rate, and method of irrigation tests, effect of rotation and fertilizers on yields and water requirements, and other miscellaneous tests. Cultural methods and field practices found profitable in producing the irrigated crop are described briefly.

Rainfall for the growing season, April 30 to October 1, was 5.5 in., and the average evaporation about 24 in. for the period. The Willamette silt loam on which the experiments were conducted has a maximum capillary water content of about 34 per cent, an optimum moisture content of about 24 per cent, and a wilting point of about 14 per cent. The minimum moisture content under field conditions is 10 or 11 per cent.

Irrigation gave a higher seasonal soil moisture content, and this was associated with higher yields, an average of 222.2 bu. being produced with irrigation as compared with 122 bu. without irrigation in a 7-year trial. Two irrigations proved better than the same amount applied with one heavy irrigation

for potatoes. Most economical returns were secured with light frequent irrigations providing a uniform moisture content, three 1-in. irrigations applied 10 days apart giving a yield of 38.6 bu. to the acre-inch.

The authors found that the best time to irrigate potatoes on this particular soil was when the moisture content in the first foot dropped to the 20 per cent point in percentage dry weight.

Potatoes have yielded most economical returns when the depth of water applied per season was 6 in. in wet seasons and 2 or 3 in. in dry seasons, while the maximum yields of tubers have been produced with 3 or 4 in. in wet seasons, and 6 in. in dry seasons. Application of 9 in. depth decreased the yield below that obtained with 6 in. of irrigation.

Water cost of dry matter or water requirement under field conditions is said to have been greatly reduced by the use of a moderate amount of irrigation. Water requirement varied about the same as the most economical return per acre-inch, and increased above the most economical yield per acre-inch. Potatoes on irrigated legume sod possessed a water requirement about 25 per cent below that of potatoes on dry farmed legume sod land.

The tests indicated that water requirement can be greatly reduced in irrigation farming by practicing a good rotation, including legume crops, by using good varieties, by maintaining a good state of fertility and tilth, by irrigating at just the right time in the proper amount, and by practicing good general farm methods.

Proper irrigation did not injure the palatability or marketability of potatoes, and it decreased the percentage of culls. Twelve years' irrigation has had little appreciable effect upon soil acidity or the content of available plant food. Soil temperature was lowered by irrigation more than by shading, or above 3° in the surface soil of potato plats. Heavy irrigation caused a higher proportion of vines to tubers, increased the moisture content of the potatoes, and, as shown by analyses reported, decreased the starch, protein, and other constituents except fat. Differences in palatability were very slight.

In central Oregon experiments, potassium sulphate increased the yield per acre-inch from 24.5 bu. on untreated to 30 bu. on treated land. In eastern Oregon experiments, irrigation of 5 to 9 in. depth an acre has given the best results in several of the potato producing sections, and frequently the best returns have been obtained with 6 to 8 in. total depth in 2 or 3 applications.

Rice investigations, F. C. Quereau (*Louisiana Stas. Bul. 172 (1920), pp. 3–87, figs. 35*).—Fertilizer tests and rotation experiments with the rice crop conducted in cooperation with the Office of Cereal Investigations of the U. S. Department of Agriculture are described in this bulletin. Cultural methods, field practices, and irrigation procedure followed in growing the crop, instructions on home mixing of fertilizers, and the eradication of red rice and other weed pests are discussed, together with notes on insect pests and diseases, including Notes on the Rice Water Weevil (*Lissorhoptrus simplex* Say), by J. L. Webb, previously noted (E. S. R., 33, p. 257).

Fertilizer tests conducted from 1910 to 1916, inclusive, indicated that 16 per cent acid phosphate at the rate of 200 lbs. per acre gave the best results with the late varieties such as Japan and Wright. The culture of rice through the use of phosphate fertilizer is not considered profitable when continued longer than 5 or 6 years. Phosphoric acid seems to be the best fertilizer for all crops on reclaimed marsh land.

Nitrogen is judged of value with the early varieties such as Honduras and advantageous for other varieties in small quantities on land in run-down condition. Most rice land needs vegetable matter, but potash did not seem to be required in the form of commercial fertilizer.

From 7-years' work, it is concluded that short rotations of 2, 3, and 4 years' duration do not seem profitable because of the high overhead expense entailed by frequent change from rice to upland crops. Deep drainage ditches, necessary for upland crops, must be filled and the entire area leveled in contour for rice. Corn is not considered an effective crop for cleaning rice land, as red rice produces seed after corn has been laid by, and soy beans or cotton are recommended in its stead.

The estimated cost of production of an acre of rice ranged from $27.26 in 1910 to $31.95 in 1917–18.

Field experiments which included the soy bean, B. L. Hartwell (*Rhode Island Sta. Bul. 183 (1920), pp. 3–16*).—Varieties of soy beans are classified into small, medium, and large yielding groups on the basis of production of beans rather than of vines, and into early, medium, and late maturing beans. Haberlandt, Austin, and Swan varieties have proved promising, combining silage production with ability to bear viable seed.

When soy beans were mixed with corn to increase the protein content of the silage, and comparisons made by growing the two crops separately as well as combined in the drill, it was found that an insufficient proportion of beans was obtained by planting the crops together in the same drill and that corn derived no advantage from the companionship. Where a fixed ratio of soy beans to corn is required for the silo, it is urged that the two crops be planted separately. Previous work along this line has been already noted (E. S. R., 40, p. 135; 41, p. 32).

When drilled for hay, soy beans yielded 1.8 tons and cowpeas 0.75 ton; broadcasted the crops yielded 1.8 tons and 0.6 ton, respectively. Grown in 12-in. pots for five consecutive summers after winter vetch was grown in the greenhouse in the winters and turned into the soil, cowpeas produced 23 per cent more dry material than the soy beans in an experiment noted previously (E. S. R., 26, p. 722).

Concerning the response of soy beans to special soil conditions, it was shown that although nitrate of soda did not decrease the growth, it did decrease the weight of bacterial nodules. Soy bean hay from limed plats contained a higher percentage of nitrogen than that taken from unlimed plats. The effect of different kinds of lime on certain ingredients of soy beans has been determined and their lime requirements compared with those of other crops in earlier work already noted (E. S. R., 32, p. 622).

The ability of soy beans to supply their needs for phosphorus, where none had been added to the soil for a quarter of a century, was found to rank between that of carrots, which obtained their full requirements, and turnips, which were practically unable to grow without phosphatic application. Soy beans derived two-thirds of their potassium needs from a soil so deficient that mangels could only obtain about one-fourth and summer squash about one-tenth of their requirements.

Sugar-beet seed growing in the Rocky Mountain States, W. W. Tracy, Jr. (*U. S. Dept. Agr., Farmers' Bul. 1152 (1920), pp. 21, figs. 15*).—This publication comprises a detailed discussion of the cultural and field practices and harvesting and storage methods involved in the commercial production of sugar-beet seed in the Rocky Mountain States.

Perennial peppergrass, a noxious weed in Colorado, A. K. Peitersen and R. T. Burdick (*Colorado Sta. Bul. 264 (1920), pp. 3–10, figs. 3*).—Perennial peppergrass (*Lepidium draba*) and its distribution and methods of dissemination are described and methods of eradication and control discussed. Suggested control methods include clean cultivation, hogging, grazing, and smothering with roofing or other material.

HORTICULTURE.

[Horticultural investigations in Alaska], C. C. Georgeson, C. H. Benson, G. W. Gasser, M. D. Snodgrass, and F. E. Rader (*Alaska Stas. Rpt. 1918, pp. 13, 22–32, 47–51, 51–54, 68, 69, 80, 81, 90–93, pls. 2*).—This is the usual progress report on varietal and cultural experiments with fruits, vegetables, and ornamentals at the Sitka Station and at the branch stations, with extracts from letters of settlers and others regarding results obtained from the seed and plant distribution and other plantings (E. S. R., 41, p. 40).

The work with orchard fruits has continued to yield unpromising results. At the Sitka Station, apple trees bloomed and set fruit fairly well but the cold rainy season prevented them from maturing. Cherries bloomed profusely, but set little fruit, which did not mature. Of the small fruits, raspberries, gooseberries, and currants did well. Thus far, dewberries, blackberries, and eastern cranberries have failed.

Breeding work with strawberries was continued. The majority of the hybrids fruiting last year had the wild berry of the interior (*Fragaria platypetala*) for one of its parents, usually the male parent. The fruit of only a few plants combined good size with the prevailing high color, fine flavor, and firmness. These plants were saved for further testing. One of the best hybrids so far produced has resulted from crossing the Magoon, a well-known strawberry on the Pacific Coast, with the pollen from the wild plant of the interior. The berry is large, deep red color throughout the surface and flesh, of good quality, and firm enough to stand shipment. Contrary to the general results secured from the salmonberry-raspberry cross, one plant from a cross made in 1916 which fruited for the first time the past season promises to be of value. The berries are salmon colored and of good size and pleasant flavor. The plant is a strong grower and shows some of the characteristics of both parents.

The usual notes are given on varietal tests of vegetables. A test made of an advertised method of growing potatoes in pens or cribs is noted on page 329. Notes are given on recently tested ornamental trees, shrubs, and perennial and annual flowers, including a list of hardy roses and other perennials.

[Report on horticultural investigations at the Crookston, Minn., Substation], C. G. Selvig (*Minnesota Sta., Rpt. Crookston Substa., 1919, pp. 24–29*).—A brief statement of results secured in 1919 in variety tests of garden vegetables and orchard and small fruits, including a note on progress made in shrub and tree planting investigations.

[Report on fruits, ornamentals, and vegetables], P. E. Miller (*Minnesota Sta., Rpt. Morris Substa., 1919, pp. 40–45, figs. 2*).—A progress report for 1919 on variety tests of fruits, ornamentals, and vegetables under trial at the West Central Substation, Morris, Minn.

[Report of the] department of horticulture, O. B. Whipple (*Montana Sta. Rpt. 1919, pp. 29–31*).—The results thus far secured in line selection work with potatoes have not been such as to recommend line selection as a satisfactory means of potato-seed improvement. Additional evidence has been secured upon the existence of intermediate degenerate types (E. S. R., 43, p. 46) and on the importance of planting the seed plat on the tuber-unit plan. The season's data also emphasized the need of giving more serious consideration to vine charactertics rather than yield records in selecting potato seed.

Studies of premature seeding in celery indicate that where plants are moved to cold frames early, premature seeding is evidently the result of long exposures to low temperatures which check the growth of the plants and not to short exposures to temperatures near the freezing point. In a variety test of

corn, Nuetta field corn and Early June sweet corn were the earliest varieties. Seed of Golden Bantam, secured from 17 different sources, showed a variation in yield of from 93 ears to 400 ft. of row for the best strain to no ears for the poorest strain. The five highest yielding varieties of dry beans tested were Hidatsa (Red Indian), Great Northern, Arikara (Yellow Indian), Whittaker, and Pilot.

In cabbage storage experiments, the varieties storing best were Danish Ballhead, Danish Roundhead, and Mammoth Rock Red. Cultural tests of onions gave results in favor of level cultivation. The station's selection of Earliana tomato yielded 10,554 lbs. per acre as compared with a yield of 5,912 lbs. per acre from Earliana seed procured from another source. Some vine-pruning tests with squashes and pumpkins indicated that pruning favors the setting of pumpkins but is of no advantage in the case of Hubbard squashes.

Of the stone fruits recently planted at the station, the plums Opata, Sapa, Hanska, and DeSoto produced very good crops. The young wood of the first three varieties killed back somewhat, but without seriously reducing the fruit crop. The DeSoto trees appear perfectly hardy. Cane fruits and gooseberries suffered considerable winter injury, whereas currants fared somewhat better.

Report of vegetable gardening work, L. G. SCHERMERHORN (*New Jersey Stas. Rpt. 1919, pp. 96–101, pl. 1*).—An outline is given of various projects under way, including data on a study of beet varieties. This study has shown that there are great differences in habit, growth, and in character of foliage at different stages of growth, and under different environmental conditions. Many strains showed uniformly distinct varietal characteristics, while on the other hand many others showed great lack of uniformity in shape and color of the roots, and of characteristic foliage.

In a suckering experiment with Howling Mob sweet corn, a table is given showing the proportion of seed corn to cob in five different bushel lots of this variety. The unsuckered rows of corn gave the heaviest yields.

[Report on horticultural investigations], C. H. CONNORS (*New Jersey Stas. Rpt. 1919, pp. 70–72, 77, 82–94, pls. 8*).—Observations are given relative to the effect of the mild winter of 1918–19 and early spring frosts on fruit buds. Breeding work with carnations was continued during the year, and about 300 seedlings were obtained. Some of the varieties seem to carry a factor for sterility, which crops out in F_1 and F_2. A further fact noted is that two varieties under observation, White Perfection and Matchless, lose the male sexual quality during certain periods. Seedlings of White Perfection carried to F_3 and F_4 lose the male characters entirely.

Tabular data are given showing fruit-growth measurements of peaches made at Vineland in 1918 and at New Brunswick in 1919. The measurements for one year indicate that temperature and rainfall do not exert very much influence upon the growth of the fruits. Growth of fruit is quite definitely divided into three stages: Rapid development of the fruit for about 45 days, apparently due mainly to increase in size of the seed part; rest period, during which the seed is formed and the stone becomes hard; and period of rapid growth of flesh to maturity, beginning 4 to 5 weeks before ripening time.

A considerable number of peach seedlings resulting from self- and cross-pollinations came into bloom in April, 1919. As indicated by tabular data here presented, almost all of the seedlings of each cross came into bloom before April 15. A few trees of certain crosses showed the desired quality of blooming as late as April 20. The yellow-fleshed seedlings seemed to lack vigor, but wherever white-fleshed varieties were crossed on yellow, a great increase in the vigor of the trees is noted. Observations thus far made indicate that the size

of petals in the blossoms of the peach behave as a unit character in inheritance and apparently follow the Mendelian ratio, with the large-petaled form dominant. The "Liberty" peach, which originated on the College Farm in 1911, as an open-pollinated seedling of Miss Lola, is described. It is the earliest freestone of commercial importance, and is being distributed among New Jersey growers.

Horse-radish a cash crop, J. L. Stahl (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 8, pp. 114, 115, figs. 2*).—Concise directions are given for growing, harvesting, and marketing horse-radish.

Study of the cost of tomato production, F. App (*New Jersey Stas. Rpt. 1919, p. 298*).—The average results of a study made in 1918 of the cost of production of tomatoes in six southern counties of New Jersey are here tabulated. The average total cost per acre was $131.17.

Cellar storage of vegetables, J. B. Keil (*Mo. Bul. Ohio Sta., 5 (1920), No. 10, pp. 266–269*).—Practical instructions are given on the management of the farm storage cellar.

[Orchard cultivation tests at the Montana Horticultural Substation], H. Thornber (*Montana Sta. Rpt. 1919, pp. 39–41*).—In the orchard cultivation experiments one plat had received continuous clean cultivation for eight years and the trees were in very bad condition at the end of this time. Now, after two cover crops of peas and one application of manure, about 16 two-horse loads per acre, almost all signs of so-called "rosette" have disappeared from all but the trees worst affected, and they are rapidly regaining their natural vigor.

Orchard cover crops, J. Oskamp (*Indiana Sta. Bul. 248 (1920), pp. 41, figs. 6*).—This bulletin presents the results of experiments with orchard cover crops conducted by the station, largely since 1914, although some of the data are based on the experiments started in 1912. The experimental plats are located on a loam soil in an orchard now eight years planted. The trees receive annual clean cultivation, the cover crop occupying the ground from the time cultivation ceases in summer until it is resumed the following spring. The list of crops grown made possible comparisons between winterkilling nonlegumes (buckwheat, millet); a winterkilling legume (soy beans); a hardy nonlegume (rye); hardy legumes (crimson clover, winter vetch); and an early *v.* a late planting of a hardy nonlegume (rye). The principal results thus far secured in this work are summarized as follows:

"The crop residues returned to the land by each crop have been determined, and they show that early rye, vetch, millet, and buckwheat rank high in the amount of dry matter and nitrogen returned, while soy beans, clover, and weeds rank low, in the order mentioned. The trees on the early rye, vetch, millet, and buckwheat plats have made significant gains in trunk girth; and these plats rank in the same order with respect to their girth gains as they do with respect to their crop residues. The soy bean, clover, and weed plats show smaller and less important gains as compared to the check plats. The two years' production records are extremely variable and less conclusive.

"There is a striking relation between the crop residue, the nitrogen in the crop residue, and growth and production. It can be concluded from the data presented that that crop is most satisfactory as an orchard cover crop which in the locality under consideration gives a consistently heavy growth of vegetation, relatively rich in nitrogen.

"The results indicate that the first week in October is too late to plant a cover crop and obtain the best effect in the orchard. The immediate effect of a vigorously growing cover crop is to deplete the soil moisture in the fall, and if the vegetation winterkills, the dead covering acts as a mulch in the spring to

conserve the moisture, but if the crop is one that winters over and starts vigorous growth in the spring, a depletion of moisture may take place. There is no conclusive evidence to show that these factors have exerted a material difference in the behavior of the trees, although moisture depletion in a dry spring may be a disadvantage.

"A cover crop can be said to protect the soil from extremes in temperature, resulting in a more uniform condition and maintaining high minima and maxima temperatures in the fall and winter and lower temperatures in the spring than bare ground. Cover crops in general have prevented as deep freezing of the soil as occurred in bare ground. The soil analyses cover only a brief period and are not conclusive."

Considerable tabular data, showing yearly increase in trunk growth by trees, yearly production by trees, soil moisture, precipitation, and air and soil temperatures, as well as humus and humus nitrogen present, are appended.

Tree surgery, J. F. Collins (*U. S. Dept. Agr., Farmers' Bul. 1178 (1920), pp. 32, figs. 24*).—This is intended primarily as a guide for those who desire to take care of their own trees or to superintend such work. It discusses the danger of neglected tree wounds, summarizes the fundamental principles of repair work, and outlines some of the better methods of treating injuries, removing dead or diseased limbs, and repairing decayed spots in the trunk or limbs.

Plant-food investigation, C. S. Beckwith (*New Jersey Stas. Rpt. 1919, pp. 448-455*).—A progress report on the fertilizer investigations with cranberries at Whitesbog, N. J. (E. S. R., 42, p. 837). The conclusions here presented are essentially those noted from another source (E. S. R., 42, p. 441), except that the present report further emphasizes the relatively small value of potash treatments and gives first place to steamed bone and rock phosphate instead of acid phosphate as sources of phosphoric acid for use on Savannah cranberry bogs. A complete formula recommended for Savannah bogs appears in a paper prepared subsequent to this report (E. S. R., 44, p. 146).

[Notes on coconuts, citrus, and papayas], L. Smith (*Virgin Islands Sta. Rpt. 1919, pp. 14, 15, figs. 2*).—Experimental plantings at the station indicate that coconut groves may readily be established in sugar cane plantations without seriously reducing the cane crop while the trees are coming into bearing. Plantings of lime trees established at the station a few years ago are proving fairly successful, although the trees are badly attacked by scale insects during dry weather and some suffer from die-back. Of a lot of budded orange and grapefruit trees imported from Florida, a few have survived, though severely suffering from die-back, and are making moderate growth. Plantings of papayas have been successfully maintained for several years.

Asexual inheritance in the violet (Viola odorata), R. D. Anthony (*New York State Sta. Tech. Bul. 76 (1920), pp. 3-55, pls. 4, figs. 8*).—Results are given of a study conducted during the past five years with the double violet, Mary Louise, which is propagated asexually. Special attention was paid to the effect of selection upon the length of the blossom stem, and also to the inheritance of high and low yield. The study as a whole was conducted with special reference to its bearing on the improvement of fruit varieties and their asexual propagation. Starting in 1914 four selection groups were made: Long-stem plants of high yield, long-stem plants of low yield, short-stem plants of high yield, and short-stem plants of low yield.

Two sets of charts were used and are here presented, one where the yield and stem length of individual plants or of clonal groups are correlated with vigor, and a second series showing the influence of location in the house upon yield, stem length, and vigor. The length of all blossom stems is reported in 0.5 in.

units and this unit is employed in the charts. Correlation tables are also given for the three factors for the entire house for each year of the experiment and for each of the four selection groups for the last year.

"Environmental factors caused considerable variation within the same greenhouse, especially the first year of the experiment. The second year, the vigor and yield were approximately the same for the long-high and short-high groups, but there was a lower stem-length average in the short-stem than in the long-stem selection. This second year four plants were grown from every plant selected as a parent the first year. The record of these four plants showed that many of the first selections, based on the performance of one plant and without a knowledge of its vigor, were not correct.

"The third year the two high-yielding selections gave a slightly higher yield than the low selections, but the difference was less than twice the probable error. At the same time in the two high-yielding selections the difference in stem-length in favor of the long-stem group was about five times the probable error and in the low-yielding selections about nine times.

"The fourth year there were supposed to be 64 plants from a common parent in 1914. In the long-stem selections, the high-yielding group averaged 3.108±0.441 blossoms more than the low yielding plants. In the short-stem selection the high-yielding plants averaged 5.787±0.478 more than the low-yielding plants. In both the high-yielding and low-yielding selections the long-stem plants averaged, respectively, 0.361±0.036 units and 0.495±0.041 units longer than the short-stem plants.

"The fifth year of the experiment, in the long-stem selections the high-yielding plants averaged 1.847±0.754 blossoms more than the low-yielding plants. In the short-stem selections the high-yielding plants showed a gain of 4.970±6.767 blossoms. The long-stem groups in both the high and low yielding selections gained 0.368±0.046 and 0.346±0.048 units, respectively.

"The process of selection has really been one of isolation whereby certain clonal lines have been selected out of the miscellaneous population purchased in 1914. We seemingly have proved only the existence of asexually inherited differences which probably were present before the experiment was begun. No attempt has been made to find when or how such differences arose.

"Though the existence of such differences in the violet makes it seem more probable that there may be differences within a single variety of any fruit, the labor and the technical difficulties involved render it inadvisable for a nurseryman to attempt to find beneficial variations among fruits by bud selection."

Plans for continuing the experiments for another five years to test the fixity of the clonal lines are briefly described.

FORESTRY.

National Forest areas, June 30, 1920 (*U. S. Dept. Agr., Forest Serv., 1920, pp. 8*).—A statistical report on National Forest areas, national monuments, national game preserves, and lands acquired in White and Appalachian Mountains under the Weeks Act to June 30, 1920.

The forest of Haguenau (*Bul. Soc. Forest. Franche-Comté et Belfort, 13 (1919), No. 4, pp. 117–146*).—A study of this French forest, including information of a general nature and the management details.

Reforestation in Belgian Kongo, J. Claessens (*Bul. Agr. Congo Belge, 10 (1919), No. 1–4, pp. 79–83*).—A short discussion of methods of conservation and reafforestation as applying to conditions in Belgian Kongo.

Regional spread of moisture in the wood of trees.—II, Moisture-spread in a graft-region, W. G. CRAIB (*Notes Roy. Bot. Gard. Edinb., 12 (1920), No. 59, pp. 187–190, pl. 1*).—Continuing a previous paper (E. S. R., 40, p. 541), the author states that newly felled timber, especially when seen in median longitudinal section, gives a visible demonstration of the distribution of moisture. Graphs constructed from the appearance of such longitudinal sections corresponded in their main details with graphs constructed from calculations following the drying of the sections. To illustrate moisture-distribution as gauged by visual examination, a photographic plate is given of a section through the graft-region of a newly felled white beam tree (*Sorbus aria*).

DISEASES OF PLANTS.

Department of botany and bacteriology, D. B. SWINGLE (*Montana Sta. Rpt. 1919, pp. 24–26*).—Notes are given of work conducted under the direction of the author, which includes a survey of the State for the eradication of barberries, studies of potato diseases, and experiments to determine the effects of arsenic on the bacterial flora of the soil.

It is said that the State has been thoroughly canvassed and practically all barberries have been removed.

A number of potato diseases have been studied, particular attention being paid to potato wilt. During the season a study was made of the species of Fusarium that are known to cause wilt and dry rot of potatoes, and the author reports that at least 8 or 10 species of Fusarium of this character are represented in Montana and that *F. tricothecioides* is the most common species.

Report of the specialist in plant pathology, December 1, 1918, to June 30, 1919, L. M. MASSEY (*New Jersey Stas. Rpt. 1919, pp. 277–287*).—A report is given of extension work for the control of diseases of sweet potatoes, white potatoes, asparagus, eggplant, and lettuce.

For the control of lettuce, demonstrations were carried on in which the soil of five cold frames was sterilized with formalin. The formalin solution was applied with a sprinkling can and the treated area immediately covered with straw mats, which were left in place for 36 hours.

Excellent results were obtained from the use of formalin, especially in the seed bed, where absolutely no loss from damping off occurred in soil which was treated as described above. It is estimated that at a cost of $17.50 for the treatment a crop worth $500 was saved.

Report of progress in demonstrations on the control of diseases of potatoes, sweet potatoes, truck crops, forage crops, and related plants in New Jersey, for the period April 1 to December 1, 1918, L. M. MASSEY (*New Jersey Stas. Rpt. 1919, pp. 535–544*).—A report is given of demonstration work in spraying various truck crops for the prevention of diseases.

The experiments on the spraying of potatoes showed that under the conditions obtaining in New Jersey it does not pay to spray early potatoes with Bordeaux mixture. Tomato spraying experiments indicated that spraying with resin-fish-oil-soap Bordeaux mixture for the control of leaf spot will result in most cases in increased yield, although the period of the ripening of the fruit will be delayed from one to two weeks. On account of the delay in the ripening of the fruit, spraying is deemed of questionable value for tomatoes grown for early marketing or for late canning purposes. It is estimated that in sections where leaf spot is prevalent an average increase of a ton or more of fruit per acre may be expected from spraying.

List of plant diseases, M. T. Cook (*New Jersey Stas. Rpt. 1919, pp. 526–535, pls. 6*).—A list is given of the more important diseases which have been reported during the year.

Saprophytic and pathogenic microorganisms, D. Carbone, B. Quarella, and G. Venturelli (*Riv. Biol., 1 (1919), Nos. 2, pp. 222–245; 3–4, pp. 409–428*).—Critical and experimental notes are given regarding selected bacterial or bacillar pathogenes, with a bibliography of about 75 titles.

[Plant diseases in Mysore, 1918–19], L. C. Coleman (*Mysore Dept. Agr. Rpt., 1918–19, pp. 17–20*).—Studies on spike include the effect of grafting and of fertilizers. Analysis of spiked sandal leaves showed a deficiency of nitrogen. *Zizyphus œnoplea*, which apparently suffers from a disease somewhat similar to spike in sandal, shows a resemblance between diseased leaves and young healthy leaves, indicating a state of arrested development as in sandal. An experiment under way shows a Zizyphus plant to which spike has been communicated from sandal by grafting, and experiments are in progress attempting to show whether budding spiked upon healthy sandal will communicate the disease. Crotalaria growing (presumably) as host to spiked sandal showed the same symptoms (small leaves, starch, etc.), but connection between the roots of the two could not be made out. Extract of spiked sandal leaf showed a rod-shaped organism after passing through a filter candle. Inoculation with this organism produced no spike symptoms.

Observations are briefly noted on a disease of cotton associated with small leaves and starch in the tissues; a Convolvulaceæ showing witches' brooms; stump rot, leaf rust, and black rot of coffee; a koleroga (Phytophthora) on wild figs (*Ficus hispida*); and a Thielaviopsis disease on plantains.

Making Bordeaux mixture, and some other spraying problems, W. S. Fields and J. A. Elliott (*Arkansas Sta. Bul. 172 (1920), pp. 3–12, fig. 1*).—The authors have investigated the best methods and conditions for making Bordeaux mixture, the effect of water hardness upon the suspension of ingredients in certain spray mixtures, and the amount of arsenic in solution in spray mixtures. The work with Bordeaux mixture is largely a duplication of that carried on by Butler (E. S. R., 32, pp. 242, 243).

The authors claim that the best method of mixing the ingredients in preparing Bordeaux mixture is that of pouring a very dilute solution of copper sulphate into a thick or strong lime solution. It is recommended that old Bordeaux mixture should not be used for spraying trees or plants. Old stock solutions of lime and copper sulphate, however, can be utilized provided they are properly kept and not mixed until used. The degree of water hardness was found to have no appreciable effect upon the precipitation of Bordeaux or Bordeaux-lead-arsenate mixtures, or on the sedimentation of lime-sulphur-lead arsenate solutions. The use of muddy water for preparing these solutions is to be avoided. The amount of arsenic found in solutions of Bordeaux mixture or lime-sulphur mixtures, when either acid or neutral lead arsenate is used, is said to be small.

A preliminary note on the germination of Urophlyctis alfalfæ, C. E. Scott (*Science, n. ser., 52 (1920), No. 1340, pp. 225, 226*).—The germination and subsequent development of the resting spores of *U. alfalfæ* are described.

An invasion of black cereal rust, C. Campbell (*Atti R. Accad. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 28 (1919), I, No. 3–4, pp. 142–145*).—Black cereal rust (*Puccinia graminis*) broke out in a region previously free therefrom, appearing in case of three Berberis plants to have been carried to wheat by the prevailing winds from infected plants in two cases and by winds varying in direction in the third case. Destruction of these plants was followed by freedom from black rust and normal crop yields.

Fungicidal dusts for control of smut, W. W. MACKIE and F. N. BRIGGS (*Science, n. ser., 52 (1920), No. 1353, pp. 540, 541*).—After calling attention to the injury to seed grain from the customary treatments with formaldehyde and copper sulphate solutions, which is said to be greater in arid regions than in humid ones because of the more frequent rupturing of the seed coats of the grain during thrashing, the authors give an account of experiments with Little Club wheat treated with solutions and dust preparations of fungicides.

The experiments were repeated from 2 to 9 times and the average effect on germination and smut occurrence was tabulated. The grain was treated with formaldehyde, copper sulphate, and copper sulphate and lime solution, and with dust preparations of copper carbonate, copper sulphate, copper sulphate and calcium carbonate combined, and copper sulphate and lime dusted separately. Two ounces of the dust per bushel of seed was required.

Row plantings were made, the seed harvested and thrashed, and the percentage of smut determined. Very favorable results were obtained by the use of the dust fungicides. Copper sulphate dust when mixed with equal parts of calcium carbonate controlled smut attacks due to seed-borne spores without damage to germination. Copper carbonate dust was equally effective. The dusts were all said to adhere well to the grain.

Studies on stinking smut of wheat, N. STRAMPELLI (*Atti R. Accad. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 28 (1919), II, No. 3-4, pp. 151-153*).—Of 15 varieties of wheat, the seed of which was exposed to infection by spores of stinking smut (*Tilletia caries*), 5 varieties showed percentages of noninfected plants ranging from 20 to 45. The percentage of noninfected grains ranged between 0.5 and 8 per cent lower.

A very susceptible variety was tested by covering the seed with 3 cm. of soil and sowing spores on the surface. The plants showed 90 per cent, the seeds 82.2 per cent, freedom from infection.

In case of infection of the soil at depths of 6 and 14 cm. below the seed layer, 100 per cent freedom from infection was obtained.

The take-all disease of wheat in New York State, R. S. KIRBY and H. E. THOMAS (*Science, n. ser., 52 (1920), No. 1346, pp. 368, 369*).—Attention was attracted early in July, 1920, to a small spot in a field of soft red winter wheat at East Rochester, N. Y., where the plants within an area 8 to 10 ft. in diameter were badly dwarfed and prematurely dead. Later, specimens from the diseased spot were examined and a fungus agreeing very closely with *Ophiobolus graminis* was isolated.

Diseased material was submitted to pathologists in England and France, who reported that the disease is indistinguishable from the take-all as it occurs in England and that the associated fungus is undoubtedly a species of Ophiobolus. The authors state that both the fungus and the disease symptoms with which it is associated agree in essential details with the take-all of wheat and *O. graminis* as described in Australia, France, and elsewhere.

As a precaution, to prevent the spread of the disease, the crop from an area 40 ft. in diameter was spread over the ground, gasoline poured over it, and the whole then burned over.

Ear cockles in wheat, W. SOMERVILLE (*Jour. Bd. Agr. [London], 26 (1919), No. 9, pp. 907-909, pls. 3*).—Continuing work carried on during 1917-18 (E. S. R., 41, p. 747), the author concludes that wheat contaminated with *Tylenchus scandens* should not be used as seed, since the germinative capacity is greatly impaired by use of copper sulphate and sulphuric acid in strengths sufficiently high to destroy nematodes.

Another corn seed parasite, J. B. S. NORTON and C. C. CHEN (*Science, n. ser., 52 (1920), No. 1341, pp. 250, 251*).—The authors describe a fungus which

has recently been isolated from sweet corn seed. This fungus is said to correspond very well, so far as its method of spore formation is concerned, with descriptions and figures of *Oospora verticilloides*, found on corn in Italy by Saccardo in 1877.

It is thought that the fungus may have been recorded under other generic names, and the sugar-cane parasite *Cephalosporium sacchari*, described as occurring in India (E. S. R., 30, pp. 650) is said to agree very well with the fungus isolated by the authors. In some of the older cultures, spores are occasionally found which suggest the possibility of a Fusarium stage. If this should prove to be the case, the authors suggest that the better name for the organism would be *Fusarium verticilloides*.

The mosaic disease of cucurbits, S. P. Doolittle (*U. S. Dept. Agr., Bul. 879 (1920), pp. 69, pls. 10*).—This bulletin deals with the nature, transmission, and overwintering of the mosaic disease of cucurbits.

No visible causal organism has been found associated with cucurbit mosaic, and the disease is said to appear unrelated to soil conditions. The juice of the mosaic plants contains an infective principle which possesses certain definite properties. It may be rendered noninfectious by heat and is destroyed by certain disinfectants. The infective principle is considered to possess many properties of a living organism, and it is thought possible that the disease may be caused by an ultramicroscopic parasite.

Nearly all the species and varieties of the available genera of cucurbits, with the exception of Citrullus, were found susceptible to the disease. The species of Citrullus appear to be partially resistant. The author reports that cucumber insects are the most important agents in the transmission of the disease both in the field and the greenhouse. The wild cucumber, possibly the host on which the infection is overwintered, in its relation to the spread of the disease is described.

Onion smut (*Gard. Chron., 3. ser., 67 (1920), No. 1748, p. 313*).—Onion smut has appeared in the northeast of England and in Northamptonshire, attacking plants in the seedling stage, and showing in black streaks on the leaves or bulb. Onions raised from healthy seed in clean soil are not infected, though soil once infected will reproduce the disease in young seedlings.

Potato diseases, A. Frank (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1920), No. 8, pp. 124–126, fig. 1*).—A popular account is given of the late blight of potatoes due to *Phytophthora infestans*, with suggestions for its control. Among the control measures recommended are the use of healthy seed, discarding infected tubers when cutting for planting, and spraying, which in western Washington should be begun about the first part of September, one or two applications of a 4:4:50 Bordeaux mixture being given the plants by the middle of the month.

Common scab of potatoes (*Gard. Chron., 3. ser., 67 (1920), No. 1736, p. 163*).—Information here presented is credited to a preliminary report of trials carried out at the University of Leeds by W. A. Millard.

Scab occurs mainly on light sandy or gravelly soils, an outstanding feature of which is that they are usually poor in organic content. The treatment which has met with best success on such soils consists in adding considerable quantities of green organic matter shortly before or at the time of planting. In these experiments no stable manure was used, since it was found that the grass itself possesses a high manurial value. A mixture of artificial fertilizers was used, however, including sulphate of ammonia and sulphate of potash, each at the rate of 2 cwt. per acre, and superphosphate of lime at the rate of 4 cwt. per acre. It is not suggested that treatment of the kind described is applicable to potato

planting on a large scale, in which case probably other means must be adopted, such as plowing in a green crop.

The "tambera" disease of potato, H. H. Mann, S. D. Nagpurkar, and G. S. Kulkarni (*Agr. Jour. India, 15 (1920), No. 3, pp. 282–288, pls. 2*).—In the Poona district particularly, but also in other localities which are mentioned, the potato is severely attacked by a disease which is called tambera, apparently on account of the reddish color of the affected plants. This disease is serious only in the case of the kharif crop (grown during the rainy season), but causes almost complete loss of that crop in some years. The disease has been under examination since 1917.

At any stage of growth, after the first month, the plants may show a slight dark spot of oily appearance on the under side of the leaves, especially on the younger foliage. These spots redden, increase rapidly in area and numbers, and finally assume a bronze color, giving a reddish tinge to the leaves. The upper foliage bunches up, the leaves wrinkle at the edges, and the leaf hairs become very prominent. The foliage withers from the top down. Auxiliary shoots are put out, but they, too, yield to the disease. All this occurs within 13 to 15 days. The tuber seldom exceeds the size of a walnut. The disease, which may spread rapidly until the whole field is affected, is attributed to the prevalence of light, misty rains during August and September.

Neither fungus nor bacteria could be demonstrated. Mites are supposed to cause the injury by sucking the juices of the epidermal cells.

The mosaic disease of spinach as characterized by its nitrogen constituents, S. L. Jodidi, S. C. Moulton, and K. S. Markley (*Abs. in Science, n. ser., 52 (1920), No. 1348, p. 415*).—The authors claim that spinach plants, especially their tops, when affected with mosaic disease have a smaller percentage of total nitrate, acid amid, and mono and diamino nitrogen, but a somewhat larger percentage of ammonia than normal plants, nitrous acid being present in diseased plants only. This is considered due to the fact that dentrification takes place whereby nitrates are reduced to nitrites. These, reacting on the various nitrogenous compounds present in the spinach, bring about the elimination of nitrogen in a free state, involving also a loss of nitrogen in the form of ammonia. Very little dentrification, if any, takes place in the roots of the diseased plants.

The mosaic disease of sweet potatoes, H. R. Rosen (*Arkansas Sta. Bul. 167 (1920), pp. 3–10, pls. 5*).—The author reports observing in September, 1918, a peculiar marking of the leaves of sweet potatoes. An examination revealed numerous fine white or chlorotic areas often inclosing small healthy looking greenish tissue, the whole producing a mottling or mosaic effect Leaves with such mottling showed uneven margins with deep lobes. Apparently the chlorotic portions of the leaf had failed to make growth, and as a consequence the green portions took the form of pouches or uneven wrinkles.

The symptoms of the disease are contrasted with similar diseases of other plants, and the author classifies the disease as a mosaic one. Observations made in the field and attempts to produce the disease by injecting juices from diseased material into sound plants, as well as by growing healthy plants alongside of diseased ones, both in field and greenhouse, failed to show that the disease was infectious under the conditions described. It was found, however, that cuttings from diseased potatoes when set in the field produced typical symptoms of infection. In addition to the aerial parts of the plant, the fleshy roots were retarded in development, in some cases a loss of 60 per cent of the crop being attributed to this trouble.

For the control or eradication of the sweet potato mosaic, the author recommends the destruction of all diseased plants, including the roots, as soon as they appear in the field. Two successive seasons of careful field observation

and of roguing diseased plants when found, it is thought, will eliminate the disease from a given lot of potatoes.

Some fungus diseases of fruit trees, H. WORMALD (*Fruit, Flower, and Veg. Trades' Jour.* [*London*], *36* (*1919*), *Nos. 25, pp. 679, 681, fig. 1; 26, pp. 705, 707, figs. 3; 37* (*1920*), *Nos. 1, p. 5, figs. 3; 2, pp. 33, 35, figs. 2*).—A brief account is given of fungicides and other control measures in connection with fruit tree fungus diseases briefly described, including apple black spot or scab (*Venturia pomi* (*Fusicladium dendriticum*); pear scab (*V. pyrina*); apple mildew (*Podosphæra leucotricha*); canker (*Nectria ditissima*); and brown rot (*Monilia* (*Sclerotinia*) *fructigena* and *M. cinerea*); plum silver leaf (*Stereum purpureum*); American gooseberry mildew (*Sphærotheca mors-uvæ*); European gooseberry mildew (*Microsphæra grossulariæ*); gooseberry bush die-back (*Botrytis cinerea* (*Sclerotinia fuckeliana*); cherry leaf scorch (*Gnomonia erythrostoma*); peach leaf curl (*Exoascus deformans*); and crown-gall (*Bacterium tumefaciens*).

Apple anthracnose or black spot canker, F. D. HEALD (*Wash. State Col. Ext. Bul. 64* (*1920*), *pp. 4, figs. 2*).—The apple canker due to *Neofabræa malicorticis* is described, the distribution being largely confined to the Pacific coast region west of the Cascade Mountains in Oregon, Washington, and British Columbia, but with a few localities east of the Cascade Mountains in Washington reported. The symptoms and effects of the disease are described, and attention is called to the fact that in addition to causing cankers on the twigs and branches of apple, pear, and quince trees, it also produces a storage rot on the fruits of these hosts.

For the control of the disease, thorough spraying and pruning are said to be essential. New infections take place only in the fall, and if the storage rot stage of the disease has been serious the orchards should be sprayed in September with a 1 : 30 Burgundy mixture or a 3 : 4 : 50 Bordeaux mixture. If the storage rot of the trees is not a factor, this spraying may be omitted.

For the prevention of the canker form of the disease the author recommends the spraying of the orchard immediately after the fruit is picked, using a 6 : 6 : 50 Bordeaux mixture. This is to be accompanied by thorough pruning, all twigs and branches showing canker being removed, and the cut surfaces painted with coal tar or asphaltum paint.

Yellows and little peach at Vineland, C. H. CONNORS (*New Jersey Stas. Rpt. 1919, pp. 72–76, fig. 1*).—A report is given of the conditions of peach trees in three experimental orchards at Vineland. These orchards were planted in 1907, 1908, and 1912. The losses due to yellows and little peach have been 14.7, 31.64, and 19.16 per cent, respectively.

The author states that the increase in the infestation from these two diseases has been gradual since they first appeared, the total loss in the three orchards amounting to 21.43 per cent. The diseases in most cases apparently entered from the borders of the orchard, although isolated regions of infection occurred in one of the orchards.

The fact that one tree had symptoms of both diseases has led the author to advance the theory that they may be caused by the same agent, physiological conditions determining whether yellows or little peach is the disease.

It is believed that trees should be removed as soon as the disease is discovered, and that replanting is perfectly safe. Only four cases have occurred in these orchards where replanted trees became diseased, and some of these trees bore several crops before it was necessary to have them removed.

Rot of date fruit, J. G. BROWN (*Bot. Gaz., 69* (*1920*), *No. 6, pp. 521–529, figs. 5*).—In 1919 the attention of the author was directed to a disease of dates, which on being studied appears to be caused primarily by an Alternaria. This

also probably conditions attack and rot by *Aspergillus* sp. and *Penicillium* sp., causing when alone mummification without the appearance of rot.

Diseases of southern pecans, S. M. McMurran and J. B. Demaree (*U. S. Dept. Agr., Farmers' Bul. 1129 (1920), pp. 22, figs. 23*).—Popular descriptions are given of the diseases of pecans due to specific organisms, those caused by environmental factors, and those due to unknown causes. Where definite means of control are known, recommendations are given.

The fungal diseases of the common larch, W. E. Hiley (*Oxford: Clarendon Press, 1919, pp. XI+204, pls. 23, figs. 28*).—This book is said to be the outgrowth of investigations primarily concerned with larch canker, but describes all diseases known to date of the common larch. Three chapters deal with larch canker (*Dasyscypha calycina*); three with heart-rot (*Fomes annosus, Polyporus schweinitzii, Poria vaporaria, Polyporus sulphureus*, and *Trametes pini*); one with the honey fungus (*Armillaria mellea*); and one with leaf and seedling diseases, including needle-rusts (*Melampsoridium betulinum* and *Melampsora tremulæ*), damping-off diseases (*Phytophthora omnivora* and *Fusoma parasiticum*), needle-cast (*Sphærella laricina*), and other needle diseases (*Meria laricis* and *Hypodermella laricis*).

The concluding chapter gives a general summary of the relations of larch to its diseases. An extensive bibliography is appended.

Larch canker (*Gard. Chron., 3. ser., 67 (1920), No. 1737, p. 175*).—This deals principally with the primary subject treated in the book above noted.

A newly discovered parasitic nematode, N. A. Cobb (*Jour Parasitol., 6 (1920), No. 4, pp. 188–191, figs. 3*).—Somewhat detailed discussion is given of *Tylenchus mahogani* n. sp., inhabiting the tissues of the mahogany tree. The nematode is said to resemble somewhat *T. musicola* and *T. coffeæ*. Trees attacked have shown no important change during 30 years.

The ascophore form of oak Oïdium in Bologna, V. Peglion (*Atti R. Accad. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 28 (1919), II, No. 5–8, pp. 197, 198*).—Study of a parasitic fungus in Bologna showed it to be *Microsphæra quercina*, the ascophore form of *O. quercinum*.

Preliminary investigation of Ribes as a controlling factor in the spread of white pine blister rust, E. G. Cheyney (*Science, n. ser., 52 (1920), No. 1345, pp. 342–345*).—An account is given of working plans adopted for the control of the spread of the white pine blister rust in Minnesota. These include a study of the sprouting of different species of Ribes, the cost and effectiveness of eradication, the number of years eradication will have to be practiced, the reproduction of different species of Ribes by seeding and layering, the effectiveness of pruning and cutting off the roots at different depths and on different dates, and the growth habits of each species of Ribes, five of which are said to be common in the State.

The results of the first year's work are considered interesting and significant, but not necessarily conclusive. Under the conditions described it is said that the number of large plants missed is very small, the number of seedlings is not excessively large, and the sprouts make up a very large percentage of the leaf surface on eradicated land. This would indicate that all the sprouts come from pieces of crown and from root ends exposed to the light, and that the sprouts can be eliminated by careful practice in eradication. Cutting of the roots appears to be more effective than pulling, as ordinary care will prevent the leaving of pieces of crown in grubbing while only extraordinary care and considerable work can prevent the leaving of exposed root ends after pulling. In the past the custom has been to pull the plants whenever possible and to grub them only as a last resort. The author believes from the preliminary results

obtained that this practice should be reversed. The initial expense will probably be greater, but in the end it will be cheaper if the grubbing eliminates the sprouts which make up the great bulk of the growth on eradicated areas.

According to figures obtained, the eradication crews attained an average efficiency of almost 99 per cent on old bushes and seedlings.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The natural history of South Africa: Mammals, F. W. FITZSIMONS (*London and New York: Longmans, Green & Co., 1919, vol. 1, pp. XIX+178, pls. 49, figs. 24; vol. 2, pp. XI+195, pls. 47, fig. 1; 1920, vol. 3, pp. XIII+278, pls. 47; vol. 4, pp. XIX+271, pls. 32*).—A popular illustrated account of the mammals occurring in South Africa. The classification of the mammals dealt with is given at the end of volumes 1, 2, and 4.

The birds of Australia, G. M. MATHEWS (*London: Witherby & Co., 1910–12, vol. 1, pp. XIV+301, pls. 67, figs. 3; 1912–13, vol. 2, pp. XIV+527, pls. 57, figs. 35; 1913–14, vol. 3, pp. XVII+512, pls. 75, figs. 19; 1914–15, vol. 4, pp. XII+334, pls. 34, figs. 4; 1915–16, vol. 5, pp. XI+440, pls. 41, figs. 6; 1916–17, vol. 6, pp. XIX+516, pls. 50, figs. 5; 1918–19, vol. 7, pp. XII+499, pls. 46*).—This folio work is illustrated with hand-colored plates of a large proportion of the species considered. Under each form the author records its synonym and distribution, presents technical description of both sexes, nestling, the nest and eggs and notes on its breeding season, and briefly summarizes the status of knowledge of its natural history, etc.

The birds of Australia.—Sup. 1, Check list of birds of Australia, I, G. M. MATHEWS (*London: Witherby & Co., 1920, pp. IV+116*).—This first part of the Folio Check List of the Birds of Australia, which is a supplement to the work above noted, deals with the orders Casuariiformes to Menuriformes. Under each genus and species are shown every synonym known to the author.

Note on the generic names Schiffornis Bonaparte and Scotothorus Oberholser, H. C. OBERHOLSER (*Auk, 37 (1920), No. 3, pp. 454, 455*).

The selection of food plants by insects, with special reference to lepidopterous larvæ, C. T. BRUES (*Amer. Nat., 54 (1920), No. 633, pp. 313–332*).—This is an extended general discussion of the subject.

[Report of the] department of entomology, R. A. COOLEY (*Montana Sta. Rpt. 1919, pp. 27–29*).—In experiments with grasshoppers, it was found that, in the preparation of the poisoned bran mash, finely powdered crude white arsenic, which can be obtained from Montana smelters at approximately 10 cts. per pound, is equally as effective as Paris green, which costs far more; that an ounce of amyl acetate (oil of banana) takes the place of eight lemons in the mash, and is much more effective; and that as good results were secured where molasses was omitted from the formula.

A brief account is given of the pale western cutworm (*Porosagrotis orthogonia*), which has appeared during the last few years in such numbers as to threaten more destruction than any species yet encountered, not even excepting the notorious army cutworm. The loss caused during 1918 in Canada by this pest has been estimated by a Canadian entomologist at more than $1,000,000, and the author estimates the loss occasioned during 1919 in Montana to reach at least that amount.

Spraying experiments with potatoes show that both arsenite of zinc and calcium arsenate are fully as effective as Paris green and a third cheaper. Promising results have been secured from the use of crude white arsenic from Montana smelters as a dust on potatoes.

Report of the department of entomology, T. J. HEADLEE ET AL. (*New Jersey Stas. Rpt. 1919, pp. 375–444, 458–519, pl. 1, figs. 5*).—A list is first given of 159 species of insects, correspondence relating to which was received and identifications of which were made during the year. Insects of particular importance during the year, briefly noted, include orchard plant lice, vegetable plant lice, rose bugs, plum curculio, codling moth, Hessian fly and jointworm, wireworms and white grubs, pear psylla, and the lined corned borer (*Hadena fractilinea* Grote).

Spraying investigations were conducted during the year with the pear psylla, in continuation of previous work (E. S. R., 42, p. 849). The results show that the dormant-season treatment, at the time that the psylla are found hanging from the twigs and branches too stiff to move, is one of the most important of the spraying methods for its control. It appears that such treatment will relieve a badly infested orchard from psylla attack until about the latter part of June, when it reappears in numbers sufficient to cause injury unless checked.

A brief discussion is given of work with the codling moth, an account of which has been previously noted (E. S. R., 43, p. 357). The emergence of the first brood of the codling moth in the latitude of Glassboro, in southern New Jersey, appears to be practically complete by June 10. Side worminess made its appearance by June 15 and began considerably earlier than that, and it continued to increase until the first week in July. In the central section of the State, in the region of New Brunswick, side worminess began to appear toward the end of June. The author believes that, under the conditions present, adequate protection can be obtained only by maintaining the coating of poisonous material upon the fruit and foliage from the time the blossoms fall until the end of the first week in July.

The responses of the larvæ of the peach tree borer to various measures for control, and additional notes, are presented by A. Peterson (pp. 402–419), much of the data being in tabular form. Tarred paper collars were experimented with during the summer of 1918, as in the previous year. A comparison of the number of larvæ per tree among check trees with those in trees with protectors about them showed about 50 per cent reduction where the protector was used. Paraffin proved to be a satisfactory seal for small protectors. Several substances were coated on the trunks of peach trees of various sizes for the purpose of repelling or killing the young larvæ as they try to enter the tree, including Parowax, Tree Tanglefoot, and the Gipsy Moth Banding Material. It appears that when thoroughly coated on the trunk of the tree above and below ground, Parowax will not keep out all young larvæ, but will bring about a moderate reduction when the infestation is severe. The few experiments with Tanglefoot and Gipsy Moth Banding Material indicate that the use of these substances will not insure complete control.

A brief account, accompanied by charts, is given by A. Peterson on the response of the eggs of *Aphis avenæ* Fab. and *Aphis pomi* DeG. to concentrated liquid lime sulphur, substitutes for lime sulphur, and other sprays, 1918–19 (pp. 420–427). An account of this work has been previously noted (E. S. R., 42, p. 250).

Some notes on the spreading quality of various contact sprays are presented by A. Peterson (pp. 428–433). In attempting to determine the spreading quality of any spray, the author finally resorted to weighing and measuring the size of drops as they fell from the end of a clean 4-mm. glass tube, thus determining the surface tension of the various liquids. The results are presented in tabular form. The spreading quality of a spray appears to be closely related to the surface tension of the material. While there are several products which,

when added to lime sulphur, will lower the surface tension, as yet nothing has been found which is practical for orchard spraying.

Experiments with the horse-radish flea-beetle, which for several years has been causing considerable injury at Brookdale, N. J., attacking most severely as the young sprouts were coming through the ground, led to the following conclusions: "(1) The beetles were not sufficiently abundant to prevent the plants from making a successful start. (2) The treatment with the mixture of powdered arsenate of lead and sulphur controlled the attack of the beetles to such an extent that the plants were able to make a better growth than occurred on any other portions of the field. (3) The Bordeaux mixture either with or without an arsenical administered a decided check to the plants, and this check was evidently sufficiently great to more than compensate for the protection from the beetles which the mixture gave them. (4) The arsenate of lead suspended in water failed to give the plants sufficient protection to enable them to make any better growth than they were able to make on the untreated plats."

In work with the onion maggot two series of experiments were conducted with poison bait consisting of 2 qt. of molasses and 1 oz. of sodium arsenite to 1 gal. of water. There were three blocks in both series, each of which block contained 10,000 sq. ft. In the first series the bait was located in clam shells, block 1 being surrounded by a row of clam shells set at 25-ft. intervals, in block 2 the bait was set at the corners of 25-ft. squares, and in block 3 at the corners of 50-ft squares. In the second series, the bait was similarly located in bunches of salt hay.

The flies began to emerge early in April before the young onions had gotten above the ground, and the poison bait was applied as soon as they made their appearance. An examination made by the author on June 6 showed a little less than 5 per cent injury on the plat where the bait was used around its outside only, and a still smaller percentage on the plats where the clam shells were placed at the corners of 25 and 50-ft. squares. A slightly higher degree of injury was found in all the plats protected by the salt hay, but in no case did the injury exceed 10 per cent and no difference could be discovered between the plats. In a field of seed onions located about 300 ft. from the hay-treated plats not less than 50 per cent of the plants had been destroyed by the maggot. On June 20 puparia were found in the ground, some being empty, indicating that the second brood had begun its emergence. It was found to be an easy matter to maintain the bait in an attractive condition in the clam shells, but very difficult on the salt hay. The results indicate that clam shells are the best carriers, and that they should not be placed farther apart than the corners of 50-ft. squares.

The work of the previous year with the Lima bean or seed-corn maggot (*Phorbia fusciceps* Zett.) was continued. An extensive series of experiments was conducted in which seed was treated with coal tar, and dusted with soot, ashes, tobacco, lead arsenate, or calcium arsenate. In these experiments the infestation was reduced, but the rotting of the seed in the field was not affected. It was demonstrated that the infestation, in some years at least, is in the soil before the beans are planted, that seed treatment materially reduces the damage and but slightly interferes with germination, and that the speed of germination does not seem to be influenced by such methods of planting or by such surface coatings as were tried.

Studies of the effect of atmospheric moisture on the rate of development of insects was continued. An attempt was made to find a practicable way of conditioning moisture content of the air in such a way as to give streams at approximately 10 per cent intervals from 1 to 100 per cent. Data obtained in deter-

mining the amount of water given off by a saturated solution of various salts to streams of dry air passing through them are reported in tabular form.

While there are at present two ways of controlling the cranberry girdler, one by flooding and the other by sanding, investigations were conducted with a view to finding a satisfactory local treatment by means of which girdlers can be destroyed as soon as their work is detected. Tests were made of weak solutions of sodium cyanid, which indicate that an application of 0.75 oz. of sodium cyanid in 18.75 gal. of water destroy all the larvæ.

In the report of mosquito work, by T. J. Headlee and M. Carroll (pp. 460–519), details are given of salt marsh draining work, the Construction of the Sawmill Creek Sluices and Tide Gates, by C. S. Beckwith (pp. 465–470), the Joint Project for Mosquito Control in Camden and Gloucester, Undertaken to Protect the War Workers at the New York Shipyards, the Pennsylvania and New Jersey Shipyards, and Camden Forge, by G. J. H. Cushing (pp. 471–473), the County Mosquito Commission Work, an account of the New Jersey Mosquito Extermination Association, brief notes on the mosquitoes of the year, and a brief analysis of the New Jersey mosquito problem.

Report of the professor of zoology and Provincial entomologist [of Nova Scotia], W. H. Brittain (*Nova Scotia Sec. Agr. Ann. Rpt., 1919, pt. 1, pp. 42–62*).—Included in this report are accounts of work with the gipsy and browntail moths, nursery stock inspection, and apiary inspection. Brief mention is also made of investigational work conducted.

Diseases and pests of cultivated plants in the Dutch East Indies in 1919, C. J. J. van Hall (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 39 (1920), pp. 50; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 8, pp. 329, 330*).—The more important insect pests are considered.

Pests of corn, L. Smith (*Virgin Islands Sta. Rpt. 1919, p. 13*).—The fulgorid *Dicranotropis maidis* is said to be the worst pest of corn occurring in the Virgin Islands. Acclimatized corn resists its attack better than newly introduced varieties, but all kinds of corn if planted during the dry months are liable to be killed by it. The fact that it has a number of host plants other than corn renders its control difficult.

Corn earworms frequently attack young corn, eating the heart of the plants. A pinch of cornmeal containing 5 per cent lead arsenate placed in the heart of each plant will kill the worms.

Principal insect enemies of the sugar beet in the territories served by The Great Western Sugar Company, A. C. Maxson (*Denver: Agr. Dept., Great West. Sugar Co., 1920, pp. VII+157, pls. 9, figs. 31*).—Following a brief introduction with a key for the determination of insects injurious to sugar beets, which is based on the nature of their injury, are nine colored plates illustrating sugar beet pests, their several stages, and natural enemies. A brief general discussion of insects and control measures (pp. 29–37) is followed by discussions of the more important pests, under the headings of root feeders and leaf feeders, with means for their control (pp. 38–128). A brief account of beneficial insects is next given (pp. 129–137), and an appendix contains an alphabetical list of the popular names of the plants and insects discussed, together with the text and illustration references (pp. 138–146). A bibliography of 44 titles and a subject index are included.

Miscellaneous nursery insects, H. B. Weiss (*N. J. Dept. Agr. Circ. 31 (1920), pp. 21, figs. 17*).—The species noted include the European mole cricket (*Gryllotalpa gryllotalpa* L.), which was imported into New Jersey a few years ago, a poplar leaf hopper (*Idiocerus scurra* Ger.), the poplar stem leaf hopper (*Macropsis virescens graminea* Fabr.), the Japanese maple leaf hopper (*Platy-*

metopius hyalinus Osb.), two oak leaf miners (*Brachys ovatus* Web. and *Brachys ærosus* Mels.), the European hornet (*Vespa crabo* L.), the red rose beetle (*Rhynchites bicolor* Fab.), the lotus borer (*Pyrausta penitalis* Grote), the verbena bud moth (*Olethreutes hebesana* Walk.), the tarnished plant bug, and the iris root borer (*Macronoctua onusta* Grote).

Dragonflies and damselflies in relation to pondfish culture, with a list of those found near Fairport, Iowa, C. B. WILSON (*Bur. Fisheries* [*U. S.*], *Bul. 36* (*1917–18*), *pp. 181–264+11, pls. 4, figs. 64*).—Included in this account are observations on the distribution, abundance, food, life history and habits, and natural enemies of Odonata. A bibliography of 62 titles and a subject index are included.

A monograph of the British Orthoptera, W. J. LUCAS (*London: Ray Soc., 1920, pp. XII+264+5, pls. 25, figs. 25*).—The author finds 31 species indigenous to Great Britain, 8 exotic forms that have become established, and an uncertain but large and increasing number that are casual visitors.

The Scutelleroidea of Iowa, D. STONER (*Iowa Univ. Studies Nat. Hist., 8* (*1920*), *No. 4, pp. 140, pls. 7*).—Iowa forms of Scutelleroidea, totaling 65 species and subspecies, are distributed in the three families as follows: Scutelleridæ, 2 genera and 4 species; Cydnidæ, 6 genera and 12 species; and Pentatomidæ, 25 genera and 47 species and subspecies. Keys are given to the genera and species. A classified list of the Iowa Scutelleroidea and a bibliography of eight pages are included.

A peculiarly marked adult of Nezara viridula L. (Hemip.), T. H. JONES (*Ent. Soc. Wash. Proc., 22* (*1920*), *No. 7, pp. 171, 172*).

Key to the Nearctic species and varieties of Erythroneura, W. L. MCATEE (*Amer. Ent. Soc. Trans., 46* (*1920*), *No. 3, pp. 267–321, pl. 1*).—This account includes keys to the six groups of species and to the species by groups, and descriptions of four new species and 38 new varieties.

The leafhopper as a potato pest, P. J. PARROTT and R. D. OLMSTEAD (*New York State Sta. Tech. Bul. 77* (*1920*), *pp. 3–18, pls. 5*).—The author records observations on the seasonal activities of *Empoasca mali* Le Baron, and reports upon field and cage experiments conducted with a view to determining its relation to potato culture and means of control. A summary of these has been noted from another source (E. S. R., 43, p. 355).

"Migration of overwintering leafhoppers to potato plantings began during early June, and the vines were sought for purposes of oviposition as soon as they appeared above the ground. Eggs were deposited largely in the young tender leaves near the growing tips of the plants, and oviposition continued until the plants were killed by frosts during early October. With the hatching of the nymphs all stages of the pest were present on the vines during the growing period. . . . The disorder attained its greatest intensity during August. At this period nymphs and adults of the second generation of the leafhopper became increasingly abundant, and intermingled with them were individuals of the different stages of the first generation. Feeding by both nymphs and adults was attended with injuries to leaf structures."

The biology and ecology of aquatic and semiaquatic Hemiptera, H. B. HUNGERFORD (*Kans. Univ. Sci. Bul., 11* (*1919*), *pp. 328, pls. 11, figs. 248*).—In this paper the author has summarized the information available concerning the biology of the aquatic Hemiptera, and has brought together descriptions of the American genera and species. A preliminary bibliography of the biology of aquatic and semiaquatic Hemiptera, partially annotated, is included (pp. 251–265).

The Cicadidæ of Kansas, P. B. LAWSON (*Kans. Univ. Sci. Bul., 12 (1920), No. 2, pp. 309–376, figs. 114*).—A synopsis of the Cicadidæ, of which 22 forms are recorded as occurring in Kansas.

The literature on the Psyllidæ and psyllid galls, F. ZACHER (*Centbl. Bakt. [etc.], 2. Abt., 46 (1916), No. 6–10, pp. 97–111*).—This bibliography, alphabetically arranged, supplements Aulmann's Catalogue of the Psyllidæ, previously noted (E. S. R., 31, p. 59).

The apple sucker quarantine, J. H. GRISDALE (*Agr. Gaz. Canada, 7 (1920), No. 10, pp. 788, 789*).—The text is given of Domestic Quarantine No. 1, which became effective August 15, 1920, and supersedes section 12 of the regulations under the Destructive Insect and Pest Act of November 28, 1919.

Pyriform scale on avocado leaf, G. F. MOZNETTE (*Fla. Grower, 22 (1920), No. 8, p. 5, fig. 1*).—This is a brief account of the pyriform scale, which frequently infests the avocado in Florida, where in 1917 it was discovered for the first time infesting cinnamon trees. In some sections of the West Indies it is known as the mealy shield scale, it is also known to occur in Panama and the Canal Zone, Venezuela, British Guinea, etc. The most satisfactory results in control have been obtained by spraying during December and January with a regular oil emulsion spray, as used in the control of white flies on citrus trees, 1 gal. of oil emulsion to 66 gal. of water being recommended.

Should cottony cushion scale be allowed to spread in Florida? W. NEWELL and F. M. O'BYRNE (*Fla. State Hort. Soc. Proc., 32 (1919), pp. 152–159*).—An account of the occurrence of this scale and of the inspection work with it in Florida.

Diseases of the silkworm, W. HARMS (In *Die Seidenraupenzucht in Venetien. Jena: Gustav Fischer, 1920, pp. 72–116, 121, 122, pls. 2, figs. 12*).—The diseases here considered are muscardine (pp. 73, 74), pebrine (pp. 74–77), grasserie (pp. 77–79), flacherie (pp. 79–109), and a new trypanosome disease due to *Herpetomonas korschelti* n. sp. (pp. 109–116). The author concludes that the *Bacillus sotto* of Ishiwata can not be identical with *B. bombycis*. A bibliography of 41 titles follows, which largely refer to silkworm diseases (pp. 121, 122).

The paddy swarming caterpillar (Spodoptera mauritia Boisd.), J. C. HUTSON (*Trop. Agr. [Ceylon], 55 (1920), No. 3, pp. 133–140, pl. 1, fig. 1*).—An account of the life history and of control measures for *S. mauritia* in Ceylon. The caterpillars appear periodically, and swarm over and destroy the young and half-grown fields of paddy in Ceylon.

Peach borer observations at Vineland, C. H. CONNORS (*New Jersey Stas. Rpt. 1919, pp. 77–82, fig. 1*).—A record was kept during the year of the number of borers removed from each tree in the Vineland orchards, in continuation of the records of previous years (E. S. R., 42, p. 849). The borer infestation increased somewhat over that of the previous year, but is still less than in any other year except 1913. The data are presented in chart and tabular form. No experiments were conducted with borer repellants, but it is stated that the cyanid treatment (E. S. R., 43, p. 359) is giving good results in a commercial way.

Diatræ saccharalis in the Province of Buenos Aires, J. BRETHES (*An. Soc. Rural Argentina, 54 (1920), No. 16, pp. 943–948, figs. 6*).—A brief account of the anatomy, biology, and means of control of the sugar cane borer in the Province of Buenos Aires, where it is an important enemy of corn.

On the origin of Pectinophora gossypiella (Saunders) in Brazil, A. M. DA COSTA LIMA (*Arch. Escola Super. Agr. e Med. Vet. [Nictheroy, Rio de Janeiro], 3 (1919), No. 1–2, pp. 41–55*).—This is a discussion of the occurrence of the pink bollworm.

Angoumois grain moth, E. A. Back (*U. S. Dept. Agr., Farmers' Bul. 1156 (1920), pp. 20, figs. 17*).—This is a popular summary of information on the Angoumois grain moth, including measures for its control.

The chrysanthemum gall midge, T. L. Guyton (*Ohio Sta. Bul. 341 (1920), pp. 99–114, figs. 7*).—This is a brief summary of information on *Diarthronomyia hypogæa* (F. Low), the first report of the presence of which in Ohio was received at the station on February 19, 1918. The pest was found attacking only chrysanthemum in the greenhouse where observations were made. Under greenhouse conditions, observations from March to May show the length of the life cycle to be from 40 to 50 days. No natural enemies were observed.

Experiments conducted have led the author to conclude that it can be successfully controlled at the time of emergence of the adult by spraying with a solution made of 1 part of nicotin-sulphate solution containing 40 per cent nicotin to 500 parts of water to which fish-oil soap has been added at the rate of 1 oz. to each gallon of solution. The treatment should be repeated every four or five days as long as any living forms of the midge remain in the galls, and every gall should be covered by the spray.

A report of investigations of this pest by Weigel and Sanford has been noted (E. S. R., 43, p. 360).

The control of mosquitoes through use of hydrocyanic acid, I, II, E. Teichmann (*Ztschr. Hyg. u. Infektionskrank., 85 (1918), pp. 1–16; 86 (1918), pp. 35–51*).—The first part of this paper deals with the treatment applicable in control of adult mosquitoes, the second part with that applicable to the immature stages.

It was found that *Culex annulatus* and *C. pipiens* are destroyed if exposed to the action of 0.02 to 0.03 per cent in volume of hydrocyanic acid (0.2419 to 0.3627 gm. HCN per cubic meter) for a period of 15 minutes. *Anopheles bifurcatus* was found to resemble Culex in its resistance to hydrocyanic acid gas. It is pointed out that hydrocyanic acid can be used against the immature stages either as a gas, applied to the water's surface, or through sodium cyanid dissolved in the water. The larvæ and pupæ of Culicidæ are destroyed within 24 hours if the stratum of air that comes in contact with the water contains 0.25 per cent per volume of hydrocyanic acid (3.024 gm. per cubic meter) for a period of 15 minutes. A 0.001 per cent solution of sodium cyanid in water destroys mosquito larvæ and pupæ within 24 hours, and a 0.0015 per cent solution is fatal to fish (*Phoxinus lævis*).

On the life history of Bucentes (Siphona) geniculata (Diptera: Tachinidæ), parasite of Tipula paludosa (Diptera) and other species, J. Rennie and C. H. Sutherland (*Parasitology, 12 (1920), No. 3, pp. 199–211, pl. 1*).—The tachinid *B.* (*Siphona*) *geniculata*, here considered, hibernates in the larval stage within its host. "Pupation may start as early as the beginning of April if the season is good, but in a late season pupation may not begin until nearly the end of this month. After a pupal period of about three weeks the imagines emerge during April and May. By the middle of June the adult Bucentes are dying off. A second generation appears in June. After a larval period of about three weeks and a pupal period of about 17 days the adult flies emerge toward the end of July. Since Tipula larvæ are found in the winter months parasitized with Bucentes, infection probably takes place in the autumn while the Tipula larvæ are comparatively young."

Investigation on the leaf beetle attacking the sweet potato, S. Takagi (*Byokingaichu-Iho. [Report of Plant Disease and Injurious Insect Research, Dept. Agr. and Com.] Imp. Agr. Bur., Tokyo, 1920, No. 7, pp. 1–7, pl. 1; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 8, p. 321*).—This is an account of a chrysomelid beetle of the Chinese Chrysochus, possibly *C. chinensis* Boly, that

attacks the sweet potato in the prefectures of Miye, Tokushima, and Tochiki, Japan.

The Cicadellidæ of Kansas, P. B. Lawson (*Kans. Univ. Sci. Bul.*, *12* (*1920*), *No. 1*, *pp. 306*, *figs. 208*).—A synopsis of the Cicadellidæ or leafhoppers, better known as the Jassidæ, of which more than 200 are here recorded from Kansas.

The aspen borer and how to control it, G. Hofer (*U. S. Dept. Agr., Farmers' Bul. 1154* (*1920*), *pp. 11*, *figs. 9*).—In the Pikes Peak region of Colorado extensive deadenings in aspen trees result primarily from the work of borers, the most common and widely distributed of which is the aspen, or poplar, borer (*Saperda calcarata* Say), although at higher elevations the bases of the trees are injured by another roundheaded borer, namely, *Xylotrechus obliteratus* Lec. which causes a large percentage of windfalls. None of the native or introduced species of poplars growing in the Pikes Peak region is immune to the ravages of the aspen borer. The heartwood of trees which are repeatedly attacked becomes honeycombed, causing dead limbs and tops which are easily broken off by the wind, finally resulting in the death of trees. Aspen shade trees are equally susceptible to injury by the aspen borer and are frequently killed or so riddled that they break off in the wind. The introduced Lombardy poplar is very seldom injured, but the commercial cottonwood of the Mississippi Valley seems to be the only native species of poplar which is at all immune to its attack.

The larva, upon hatching from the egg deposited in the bark of living, healthy, and injured trees at once begins its destructive work by feeding and mining between the bark and the wood, in which it remains for from 90 to 100 days. Then it enters the sapwood and heartwood, where it excavates an oval-shaped longitudinal gallery 6 to 14 in. in length.

In some localities the standing dead, fallen, and dying trees exceed 50 per cent of the total stand. One of the chief causes of the rapid deterioration and death of trees attacked by it is a wood rot or fungus (*Formes igniarius*), which follows the work of the borer and destroys the heartwood. The development of this disease is often so rapid that it envelops and destroys the borer larva before it matures.

The species is found in all parts of the country, its distribution being that of the poplar. Normally there is but one generation in three years. The eggs are deposited the latter part of July and during August, one or two eggs being placed in an oblong scar gnawed into the cambium. The larvæ hatch in from 20 to 25 days, whereupon they mine beneath the bark, remaining there over winter, and entering the sapwood and heartwood the following spring, where they are active until May or June of the second year following oviposition. Upon reaching full growth the larva excavates the pupal cell near the lower end of the larval mine and remains inactive in this cell until the following spring, when it pupates and remains as a pupa 25 to 30 days before transforming to the adult. The adult emerges during the latter part of July or during August of the third year.

An hymenopterous parasite is said to destroy an average of 25 per cent of the borer eggs, and 5 per cent of the larvæ are destroyed by dipterous parasites. Less than 1 per cent are destroyed by predaceous insects and birds, while a fungus disease destroys 2 per cent of the mature larvæ, pupæ, and immature adults. Thus the total annual mortality of the borer from these causes is from 30 to 38 per cent.

Found associated with it are the bronze birch borer (*Agrilus anxius* Gory.), a flat-headed borer (*Pœcilonota cyanipes* Say), *Dicerca prolongata* Lec., *Cossus* sp., *Xyloterus* sp., and *Xylotrechus obliteratus* Lec.

The infestation is said to be most prevalent between altitudes of 6,500 and 8,000 ft. and it is not found to occur above 9,000 ft. Trees on dry rocky slopes appear to be more subject to attack than those in less exposed situations.

Control experiments conducted from 1914 to 1917 in various localities and upon various clumps of aspen have shown two methods to be practicable, and that the insect can be controlled if not entirely eliminated by either of them. These methods are (1) the cutting of "brood trees" in May or June and (2) the application of creosote or carbolineum to the egg scars, preferably in October.

Soil grubs, L. SMITH (*Virgin Islands Sta. Rpt. 1919, p. 11*).—The method of controlling soil grubs, particularly *Strategus titanus*, by means of poisoned bagasse, devised and advocated by the author,[1] is said to have given good results at a plantation upon which it was well tested. The method consists in inserting handfuls of bagasse mixed with Paris green in the soil at intervals of about 5 ft.

Pine weevils (*[Gr. Brit.] Forestry Comn. Leaflet 1 (1920), pp. 12, figs. 5*).—Accounts are given of the large brown pine weevil (*Hylobius abietis* L.) and of the banded pine weevils (*Pissodes pini* L. and *P. notatus* F.).

The fall feeding of bees, L. B. CRANDALL (*Conn. Agr. Col. Ext. Bul. 21 (1920), pp. 11, figs. 6*).—This paper furnishes practical information for the beekeeper.

Wood's place in the honey industry, H. MAXWELL (*Amer. Forestry, 26 (1920), No. 322, pp. 599–604, figs. 15*).—A discussion of the use of wood in apiculture and of the bloom of trees as sources of honey.

The beekeeper's vade-mecum, H. GEARY (*London: Stanley Paul & Co., 1920, pp. 202, figs. 62*).—This is a vest pocket guide to beekeeping.

On the outbreak of Nematus abietum Hrtg. in the Naunhofer Forest, SINZ (*Tharand. Forstl. Jahrb., 71 (1920), No. 4, pp. 194–214*).—Much of the data relating to the injury by this pine sawfly is presented in tabular form

Notes on the Harris collection of sawflies, and the species described by Harris, S. A. ROHWER (*Jour. Wash. Acad. Sci., 10 (1920), No. 18, pp. 508–518*).

The Argentine ant in France, P. MARCHAL and R. POUTIERS (*Jour. Agr. Prat., n. ser., 33 (1920), No. 18, pp. 319–321, fig. 1; Bul. Soc. Étude et Vulg. Zool. Agr., 19 (1920), No. 8, pp. 91–93*).—A brief account is given of *Iridomyrmex humilis* Mayr, which has become established in the southeast of France near Toulon, where it has spread over an area of 10 hectares (24.7 acres), and in the vicinity of Cannes, where an area of 150 hectares is infested. Its distribution indicates that it has been established for 10 or 12 years.

Contribution to the knowledge of the microhymenopterous parasites of the pink bollworm in Brazil, A. M. DA COSTA LIMA (*Arch. Escola Super. Agr. e Med. Vet. [Nictheroy, Rio de Janeiro], 3 (1919), No. 1–2, pp. 57–63*).—The chalcidid parasite *Trigonura annulipes* from a pupa, the eupelmid *Encyrtaspis proximus* and a braconid (*Bracon* sp.) from cotton seed infested by the pink bollworm, and *Scambus* (*Epiurus*) sp. are described as new.

A gamasid mite annoying to man, H. E. EWING (*Jour. Parasitol., 6 (1920), No. 4, pp. 195, 196, fig. 1*).—A brief account and description is given of *Hyletastes missouriensis* Ewing, which was found to be a source of annoyance to man in the vicinity of Washington, D. C., in 1919.

Quantitative studies in the food of spiders, S. W. BILSING (*Ohio Jour. Sci., 20 (1920), No. 7, pp. 215–260*).—This is a report of studies of the food habits of the spiders most abundant in the vicinity of Columbus and Crestline, Ohio, which commenced in June, 1913, and extended over a period of six months. The details relating to the insects fed upon are presented in tabular form.

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[1] St. Croix Agr. Expt. Sta. Rpts. 1912–13, p. 40; 1913–14, p. 26; 1914–15, p. 24.

It was found that 64 per cent of the insects destroyed were of an injurious character, 19 per cent of a beneficial nature, and 2 per cent neither injurious nor beneficial to farm crops. The other 15 per cent represented a varied number of different insects, a few of which were beneficial, but the majority of which had no direct bearing either way as regards farm crops.

FOODS—HUMAN NUTRITION.

Some factors related to the quality of wheat and strength of flour, W. L. STOCKHAM (*North Dakota Sta. Bul. 139 (1920), pp. 69, figs. 16*).—A large amount of experimental work of the station is summarized, with frequent citations from the work of other investigators, furnishing as a whole a comprehensive discussion of the factors which determine quality in wheat and strength of flour.

"The strength of a flour is its apparent and potential ability to make a large good textured loaf, that of a wheat its production of strong flour, and of a variety the general average rank of flour from it as compared to other varieties grown under the same conditions. The strength of a class of wheat is the rank of its flour compared to that of other classes when each are grown under the conditions for which they are adapted. Strength is limited largely by varietal inheritance and climate.

"Hard red spring wheat ranks first in strength, followed in order by hard red winter, durum, soft red winter, and soft white winter.

"The best grades of flour from any class are those from the reduction of purified middlings and free from particles not natural to the endosperm of the wheat.

"Within any variety smallness in size of kernels usually indicates greater relative strength. The extremely small kernels, however, are sometimes very weak. Size is of little importance in comparing classes or varieties. The hard spring and winter classes, which rank highest in strength, average smaller than the softer classes.

"External color of wheat is not closely related to strength.

"The hard vitreous kernels are the stronger except in the extremely hard and badly shrunken material.

"Bright samples of wheat are relatively more free from bacteria and molds than those which are bleached or damaged. A badly frost-damaged sample was free from bacteria and molds.

"The softer the wheat and lower the grade of flour the less granular the flour. Damage changes the flour texture.

"The composition of the kernels is influenced somewhat by the soil but more largely by the moisture conditions. The best conditions for growth produce a lower protein content and larger yield per acre but wheat lower in strength than that where conditions are not favorable because of insufficient or excessive moisture.

"The natural soil nitrogen in the drier regions is higher where that in the wheat is low. The opposite is true in the more humid sections. Nitrogen applications may increase the nitrogen content and strength of wheat. Wheats from the plats continuously planted to wheat did not differ materially in strength from those from the rotation plats.

"In all classes of wheat the nitrogen percentage gradually increases from the interior of the kernel to the outer layers except in the bran, where it again decreases. The grade of flour having the lower nitrogen content is likely to be stronger than those of higher nitrogen content from the same wheat. The outer layers are weakening.

"Added gluten increases the volume of the loaf. On the average with all grades of flour, the higher the percentage of protein the greater the strength to a certain point. Beyond this in the harder classes there are indications of weakness. Protein from hard red spring and hard red winter wheat because of its physical condition and surroundings is more efficient, i. e., flours of these classes are stronger than those of the soft winter and durum of the same protein content considering the prevailing varieties grown.

"The lower grades of flour generate gas at a more rapid rate during fermentation than the higher, and their weakness therefore must be attributed to other causes. Lack of gas generation is the limiting factor in strength in some cases, but one which may be overcome artificially. The quantity of water extracts is related to the gas generating power of a flour, but does not parallel strength because of the high percentage of extractives in low-grade flour. Bin-burned wheat flours were not unusually high in extractives.

"The common inseparable impurities of wheat were not high in extractives except vetch, which sometimes stimulates fermentation in flours containing a low proportion of it.

"The ether extract of wheat is a decided improver of baking quality and strength, differing in this regard from other fats tried and the fatty acids.

"The percentage of total nitrogen of a straight flour soluble in a 5 per cent potassium sulphate solution is a less valuable index of strength than the total nitrogen figure.

"Amylolytic enzyms contribute to fermentation and large loaf volume. Proteolytic enzyms of wheat tend to weaken the gluten. The scutellum of the germ is the chief source of the enzyms. The higher grades of flour are more free from them than the lower. . . . Proteolytic activity gradually decreases in flours in storage. Sprouted wheat flours retain their activity in storage for a few years. The gluten is an aid and possibly an essential to an increase of the enzym which destroys it.

"The proteolytic activity of wheat is greater than that of the flour from it. The more active samples usually produce a flour requiring a shorter fermentation period in the pan. Flours of the same grade are not strong or weak according to their proteolytic activity. High proteolytic and high amyloytic activity are usually associated.

"Weathering increases and distributes the enzyms of wheat. Bin-burned wheat was still active proteolytically.

"Flours of the same protein content from different classes of wheat differ in average absorption. There is the same deficiency of the soft red winter. Durum protein ranks highest. The strength limits of any class of wheat are better measured by absorption protein ratio than by the percentage of crude protein.

"Although the percentage of ash runs up with protein content, a higher portion of the water would function in overcoming stiffness and would be more available for fermentation.

"Too high tempeature during fermentation for baking produces an irreparable damage.

"The quantity of ash of wheat bears the same general relation to strength of the wheat as that of the flour from it. Hard red spring wheats high in ash yield flours high in ash and relatively strong in most cases.

"The quantity of moisture sufficient to prevent gluten recovery from a flour is closely related to the amount necessary for gluten reactions at the time of kernel formation. The tendency for gluten particles to cohere depends upon the amount of available moisture and the severity of mechanical treatment.

"The weaker acids are dispersive to gluten over greater range than the strong, and the concentrations necessary to overcome their own dispersive effects are greater. The relative conductance of a normal solution of various acids ranks them fairly well as to the critical concentrations for overcoming dispersion.

"Dispersion of gluten is also produced by some organic salts and a tendency toward dispersion by antecedent and cleavage products of gluten. The fatty acids and acids of wheat fat do not produce dispersion. The ability of salts to overcome dispersion is determined by the valence product of the salts primarily, salts of heavy metals being relatively more efficient, however, than salts of equal valence and less mass.

"Normal salts in low concentration do not greatly affect the baking strength of strong flour. The period of maximum gas formation is not changed greatly by their addition though some stimulating action results. Uni-univalent salts are less harmful as a rule than those of higher valency type. Most of the acid salts except those of phosphoric and the weak organic acids are disastrous to strength. Strong flours may stand more acid than the weak. In fact, they may occasionally be improved thereby.

"Acids adversely change the shape much more than salts and alkalis in equivalent concentrations. Salts influence the absorption of starch similarly to that of gluten. Starch gives lower figures with alkalis, and with mineral acids lower than organic when treated as dough. Dehydration reduces absorptive capacity of starch, and hydration increases it.

"Starch is continually undergoing change as is gluten. Starch is more permeable than gluten. Salt and acids produce increases in permeability, and mixtures of the two are very active in this respect.

"The conditions within which lecithin has its colloidal properties modified are similar to those for the modification of gluten.

"A flour increases in strength in storage under good conditions for a few months, remains fairly constant for a time, and deteriorates after a period of approximately two years. Flour from wheat nine years old deteriorates in four months. The rate of deterioration of flour is about four times as fast as with a wheat under the same conditions.

"Salts of a higher valency interfere less with vital phenomena than those of low valency and are relatively less active in the presence of colloidal material because of their precipitating effects. Though salts in dilute stimulating concentrations increase the rate of vital changes, they may not increase the total amount of material converted.

"The germ is the chief source of oxidizing enzyms. They have little bearing on strength but are responsible or related to some color reactions of bran and low-grade flours."

Contribution to the study of the composition of maize, N. Passerini (*Bol. Soc. Ital. Studio Aliment., 1 (1919), No. 1–3, pp. 17–22*).—Proximate analyses and nitrogen determinations of eight varieties of Indian corn from different sources are reported.

Peach sirup and jam, C. H. Connors (*New Jersey Stas. Rpt. 1919, pp. 94–96*).—Suggestions are given for the utilization of small and overripe peaches not suitable for packing in making sirups and jams. For the sirup, fully ripened fruit is allowed to stand several hours after picking and is then washed and crushed in the hands, heated gradually to boiling, and cooked for several hours, after which it is strained through cheesecloth, replaced in the cooker, and evaporated to proper consistency, sugar being then added in the proportion of 1 part of sugar to 3 or 4 of the juice. For the jam the fruit is blanched, peeled, and cut in slices as soon as possible after picking. The material is placed in the

cooker, and after adding a small amount of water is heated gradually and cooked until soft. Sugar is then added in the proportion of 1 part of sugar to 6 parts of the material if the jam is designed for the household use and is to be packed in sealed jars, while if it is not to be packed in air-tight vessels 1 part sugar to 3 or 4 parts of the material should be used.

The quantity, flavor, and color of both products varies with the variety of peach used. The average amount of sirup is estimated at 3 qt. and of jam 5 or 6 qt. per basket of fruit.

Report upon the methods used for the inspection of canned foods and their reliability for this purpose.—I, Canned meat, W. G. SAVAGE [*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd., Spec. Rpt. 3* (*1920*), *pp. 23*).—This report, which is the first of a series on the general subject noted in the title, deals only with canned meats imported into England. The methods employed in the commercial canning of meat, in so far as they may affect the physical properties of the cans as they come before the food inspectors, and the methods of inspection in England at ports of entry are described. To determine the reliability of the methods of examination employed, a comparative study of the findings of the examiners, the actual physical condition of the meat when opened, and the results of bacteriological and chemical examination was made in 73 cases at 5 ports of entry. The results obtained, which are classified and discussed, are summarized in the following table:

Examination of canned meat.

Judgment of food inspectors.	No of samples.	Meat good and sterile.	Meat good not sterile.	Meat unfit.	Correct judgments.	
					Condition of the meat.	Sterility.
					Per ct.	*Per ct.*
Passed	16	15	0	1	94	94
Rejected	57	31	11	15	26	45.6
Total	73	46	11	16	41	56

In discussing the large percentage of cases in which the condemned meat was sound and fit to eat, it is pointed out that the wrong diagnosis in most cases lay with the tins disqualified as leakers. In the opinion of the author, the only method to distinguish between sound and unsound meat in such cases is to open the cans and subject the meat to naked-eye examination. The possibility is suggested of replacing the sound meat in fresh tins and reprocessing it.

[**Studies of food and drug problems**], A. K. JOHNSON (*North Dakota Sta. Spec. Bul., 6* (*1920*), *No. 2, pp. 28*).—In addition to discussions of saccharin in food as a menace to health; a large increase in retail prices over wholesale prices of fruit; and a report of analyses of proprietary medicines, and some similar data, this number contains the following:

Cost of handling fruit, F. C. Himber (pp. 19–23).—The increased cost between producer and retailer, particularly the cost of shipping and handling, is analyzed.

The food value of some apple-butter substitutes compared to that of real apple butter, W. G. Bowers (pp. 23–26).—This includes detailed analyses of two such products which would indicate that the so-called apple-butter substitutes consist of corn starch, corn meal, acids, spices, pectous material, etc. In conclusion,

the author suggests that "the public runs a risk in choosing the substitute (with its apparently greater food value), at 9 cts. per pound in preference to the real at 11 cts. per pound, even in the face of the opportunity to reduce the 9 to 4.5 or 5 cts. We must bear in mind that the human system has been accustomed to a diet in which there is a portion of the natural fruit products with their natural fruit sugars, and that there is danger of overtaxing the starch-digesting capabilities. We should all at least recognize that apparent danger until we arrive at a more definite solution of the problem."

Wheat of 1920 crop, T. Sanderson (pp. 27–28).—This discusses questions of costs and increased prices. The author charges that "the consumers are charged a price for the mill products based on the cash price of high-grade wheat, while the farmer is paid a price at the local elevator based on the option market, which at present penalizes him 14 cts. per bushel, while the consumer is charged 31 cts. per bushel in excess profits."

Discussion on the present position of vitamins in clinical medicine (*Brit. Med. Jour., No. 3109 (1920). pp. 147–160, figs. 6*).—This symposium, which took place at the annual meeting of the British Medical Association in July, 1920, was opened by F. G. Hopkins who touched upon certain general considerations in regard to deficiency diseases, and discussed briefly scurvy, beriberi, xerophthalmia, and rickets. New evidence in regard to the stability of fat-soluble A was furnished in the report of experiments on rats, showing that butter heated at 120° C. without aeration retained its growth-promoting properties, while similar samples through which air had bubbled during the same period of heating completely lost their growth-promoting properties, thus indicating that the vitamin, while having considerable heat stability, is easily oxidized.

In the discussion which followed J. Barr attempted to explain many of the results attributed to vitamins as being due to the action of calcium salts. H. Chick and E. J. Dalyell discussed their recent work on deficiency diseases in Vienna, and showed the beneficial effect in the feeding of undernourished children of the application of principles learned in animal experimentation. R. McCarrison drew attention to the profound effect of dietetic deficiencies on the digestive organs.

A. F. Hess stated that the antiscorbutic factor as well the fat-soluble factor is evidently lessened by oxidation, as shown by the fact that commercially pasteurized and homogenized milks are less potent as antiscorbutics. Attention was also called to the individual distinctions which should be made between the antiscorbutic properties of the same foodstuffs under different conditions owing to the peculiar instability of the antiscorbutic vitamin. G. F. Still pointed out that some individuals required a larger intake of vitamins than others, and cited in illustration cases of infantile scurvy which required varying amounts of antiscorbutic vitamin to effect a cure.

L. Williams emphasized the therapeutic efficacy of an intensive vitamin dietary composed entirely of uncooked foods. Statistics presented by H. C. Mann on the factors prominent in over 400 cases of rickets showed that 44 per cent occurred on diets containing a deficiency of fats or a deficiency of fats with carbohydrate excess, while 16 per cent occurred on breast feeding. W. H. Wilcox gave illustrations of scurvy and beriberi during the European war, E. Pritchard emphasized the importance of calcium in the etiology of rickets, and S. M. Copeman called attention to the value of restriction of growth-promoting vitamins in cases of cancer or tumors.

Scurvy, with special reference to prophylaxis in the Royal Navy, P. W. Bassett-Smith (*Lancet [London], 1920, I, No. 21, pp. 1102–1105, figs. 4*).—In this paper the author traces the history of scurvy from early times to the present

day, discusses the relationship of scurvy to other diseases, and describes the preparation of an active antiscorbutic from lemon juice as follows:

The fresh juice is filtered through muslin and then through filter paper under reduced pressure. The filtered juice is evaporated in vacuo over sulphuric acid at ordinary temperature and the sirupy residue made into as stiff a paste as possible with a mixture of 97 per cent anhydrous lactose and 3 per cent gum tragacanth. The paste is cut into sections, each containing the juice of half a lemon. These are then rolled and pressed into the shape of lozenges.

Experiments are reported in which these tablets were used both prophylactically and therapeutically on guinea pigs with excellent results, one-fifth of the tablet, equivalent to 4.8 cc. of fresh lemon juice, representing the minimum preventive dose. It is estimated that one tablet, the equivalent of half a lemon, would be ample as a prophylactic dose for adult human beings, and it is suggested that this tablet should be added to the ordinary nonactive lime juice at present issued to the British Navy as an antiscorbutic.

Scurvy (*Med. Sci., Abs. and Rev., 3 (1920), No. 1, pp. 9–14*).—This is a brief review of recent literature on scurvy, particularly as relating to its prevalence and manifestations in the different armies during the European war. A list of 17 literature references is appended.

ANIMAL PRODUCTION.

The types of spotting in mice and their genetic behavior, M. Sô and Y. Imai (*Jour. Genetics, 9 (1920), No. 4, pp. 319–333, pls. 2*).—The authors report breeding experiments in Japan with various types of spotted mice, leading to the identification of a new factor *D*.

When *D* is associated with *S* (self color) it produces a pattern called kasuri (the dominant spotting of Durham, the type A of Little) and when associated with *S'* (recessive spotting) it produces the daruma pattern (black-eyed white of Little). It was possible in most cases to distinguish between the kasuri pattern and recessive spotting by external appearances, the former being characterized by "fine silvered markings."

The death in utero of homozygous black-eyed whites noted by Little (E. S. R., 42, p. 763) is attributed to the failure of *DD* individuals to survive, since the matings daruma×daruma and kasuri×kasuri both resulted in 2:1 ratios.

Types of white spotting in mice, L. C. Dunn (*Amer. Nat., 54 (1920), No. 635, pp. 465–495, figs. 3*).—Breeding experiments with spotted mice of various types are reported, particular attention being given to the variation in the amount and distribution of white on the body.

Type C, a new variety of dominant spotting, is recognized. This type is homozygous for self-color and shows a narrower range in the amount of dorsal white than Little's Type A, which is heterozygous for self. Some genetically self animals showed small amounts of dorsal spotting, while white patches on the belly were found not to be influenced by the self factor.

The tortoise-shell tomcat.—A suggestion, L. Doncaster (*Jour. Genetics, 9 (1920), No. 4, pp. 335–338*).—It is suggested that the sterile tortoise-shell tomcat may be a freemartin, i. e., a female masculinized in utero by the confluence of its vascular system with that of an adjoining male fetus. This idea is based upon the studies of Lillie and Chapin (E. S. R., 40, p. 466) and observations[1] on the histology of the testes of a tortoise-shell tomcat, which, it is stated, resemble the gonads of freemartins. Objections are urged against the hypothesis of Little (E. S. R., 42, p. 763) that tortoise-shell males are produced by nondisjunction of the sex chromosome and the mosaic inheritance of yellow.

[1] D. W. Cutler and L. Doncaster, Jour. Genetics, 5 (1915), No. 2, pp. 65–73.

The genetics of the Dutch rabbit.—A criticism, R. C. PUNNETT (*Jour. Genetics, 9 (1920), No. 4, pp. 303–317, pl. 1, figs. 2*).—The author has examined the rabbit-breeding experiments of Castle (E. S. R., 42, p. 762) in the light of his own studies in the inheritance of Dutch pattern. It is concluded that Castle's hypothesis of multiple allelomorphs does not explain the facts satisfactorily and that there are at least three independent pairs of allelomorphs concerned with the different grades of pigmentation.

On the postnatal development of the ovary (albino rat), with especial reference to the number of ova, H. ARAI (*Amer. Jour. Anat., 27 (1920), No. 4, pp. 405–462, figs. 4*).—The numbers of ova in the ovaries of 39 laboratory rats ranging from birth to old age were determined by counting the well stained egg nuclei in serial sections of the entire ovary.

It was found that the weight of the ovaries but not the number of ova increase continuously with age. During the first three weeks after birth the number of ova (total of both sides) decreases from about 35,000 to 11,000. There is then little change until puberty (age of 65 days), but with the appearance of corpora lutea the number of ova suddenly decreases to 7,000. Thereafter the decline in number is slow but steady. The decrease in number is due primarily to the degeneration of the primitive ova, but the definitive ova, which are constantly being formed from the germinal epithelium even for a considerable period after puberty, also degenerate.

On the cause of the hypertrophy of the surviving ovary after semispaying (albino rat) and on the number of ova in it, H. ARAI (*Amer. Jour. Anat., 28 (1920), No. 1, pp. 59–79*).—The right ovary was removed from a series of rats at the age of 20 days to determine whether the hypertrophy of the surviving ovary, observed to follow semispaying by Hatai (E. S. R., 34, p. 263) and others, is due to an increase in the number of ova. It was found, however, that semispaying produced no modification in the number of ova in the surviving ovary except to hasten slightly the reduction in number with advancing age. Before puberty the excess in weight (about 40 per cent) of the surviving ovary was found to be due to a greater number of large follicles, while the weight after puberty (about double the normal) was due to an increased number of corpora lutea. The corpora lutea were sufficiently numerous that the number of young in litters of semispayed females was but slightly below normal. There was no indication that an increase in the stroma tissue contributed to the hypertrophy.

The origin, growth, and fate of osteoclasts and their relation to bone resorption, L. B. AREY (*Amer. Jour. Anat., 26 (1920), No. 3, pp. 315–337, pls. 4, figs. 2*).—From a study of histological preparations of developing membrane bone of human and pig embryos and an examination of the literature, the author concludes that the large multinucleate cells known as osteoclasts are merely stages in the degeneration of osteoblasts that have finished their career of bone building. No evidence was found for the common assumption that these cells are concerned with the resorption of bone tissue.

Oil cakes in animal feeding, P. DECHAMBRE (*Les Tourteaux Oléagineux dans l'Alimentation des Animaux. Paris: Augustin Challamel, 1919, pp. 64, figs. 4*).—This is a treatise on the chemical composition of peanut cake, coconut cake, and palm kernel cake, and their utilization in feeding. There are brief comments on the importance of these products in the commerce of the French colonies.

Food control from the standpoint of nutrition, E. V. MCCULLOM (*Feedingstuffs, 36 (1920), No. 3, pp. 19, 20*).—The author holds that a list of the principal ingredients and some indication of their proportions should be stated on the label of proprietary feeds so that the feeder can avoid using incomplete

proteins from single grains by making intelligent combinations with other feeds. The possibility of grading feeds on the basis of the quality of their proteins is also discussed.

[Association of Feed Control Officials.—Eleventh and twelfth annual meetings] (*Feedingstuffs, 35 (1919), No. 6, pp. 19–22, 32, 42, 45, 50, 54; 37 (1920), No. 6, pp. 19–21, 25–28, 31, 32, 34, 47, 48, 50, 52*).—These are the reports of proceedings of the meetings held in November, 1919, and November, 1920. Reports of previous meetings have been noted (E. S. R., 41, p. 564).

The 1919 report includes the presidential address of J. W. Kellogg and the routine discussion of definitions. The 1920 report includes the addresses of Patten, Chapin, Silberberg, Maynard, and Vestal previously mentioned (see p. 300), routine discussions, and the official and tentative definitions adopted. The 1919 meeting decided to designate the three grades of cottonseed meals as choice, medium, and low-grade, but at the 1920 meeting this action was reconsidered and the old names, choice, prime, and good were tentatively restored.

Cycles of production for cattle, sheep, horses, and hogs, E. B. Bleecker (*New Jersey Stas. Rpt. 1919, pp. 319–324*).—This is a study of the cyclic changes in the prices of live stock and their influence on production. With hogs the average cycle (interval between two periods of high prices or two periods of low prices) was found to lie between 6 and 7 years. With sheep it is about 9 years, with cattle 13 years, and with horses 17 years. The farmer is advised to study the trend of prices so as to avoid the losses coincident with ill-timed production.

British breeds of live stock, [R.] Wallace, rev. by J. M. Webb (*London: Min. Agr. and Fisheries, 1920, 3. ed., pp. 136, pls. 45*).—This compilation contains a brief history and description of each of the breeds of horses, cattle, sheep, and swine occurring in Great Britain and Ireland. Poultry descriptions found in the first edition (E. S. R., 25, p. 372) are omitted. An appendix gives a list of the recognized breed societies, the principal places of public sales, exhibitions and shows, and the prices realized at sales.

A number of societies have been organized in recent years to maintain and improve some of the nearly extinct local breeds of sheep and pigs. A similar tendency among cattle breeders is indicated by the formation in 1919 of societies interested in the Blue Albion and Old Gloucestershire breeds and by the first appearance of Park cattle in the show ring as a recognized breed at the Royal Agricultural Society's show of 1920.

[Experimental cattle crosses in Alaska], H. E. Pratt (*Alaska Stas. Rpt. 1918, pp. 89, 90*).—Five Holstein×Galloway calves have been born at the Kodiak Live Stock and Breeding Station. The calves are all black and polled but have more white on the underline than the average Galloway. In conformation and hair characters they seem to resemble Holsteins. It is stated that the milk yields of pure-bred Holsteins in the herd are seriously affected by cold rains.

Beef cattle [feeding experiments], W. E. Joseph (*Montana Sta. Rpt. 1919, p. 22*).—In a study of cottonseed cake as a supplement to straw for wintering beef cows, it was found that 1 lb. of the cake is equal to about 5 lbs. of mixed alfalfa and timothy hay when each is fed with unlimited amounts of straw. Mention is made of a preliminary test of sunflower silage for beef calves showing that the silage did not produce quite the gain of mixed timothy and alsike hay.

Grass fat cattle warmed up on corn fodder with a straw shed for shelter, J. H. Shepperd (*North Dakota Sta. Bul. 140 (1920), pp. 8, figs. 6*).—A violent blizzard late in October, 1919, made it necessary either to provide a shelter for a group of 51 2-year-old steers that had been on grass during the summer

or to sell them at once when the market was flooded with grass cattle. The first alternative was adopted, and a temporary shelter of rough boards and worthless baled straw was constructed. The steers were fed on corn fodder for 58 days and made an average daily gain of 2.5 lbs per head. They were sold late in December when the market was much more favorable.

Corn and millet silage for fattening cattle, J. W. WILSON and A. H. KUHLMAN (*South Dakota Sta. Bul. 189 (1920), pp. 205–220*).—Two cattle feeding experiments are reported. The first began in February, 1919, involved 4 lots of 5 steers each, and was planned as a comparison of silages made from 4 varieties of corn. There were 4 lots of 4 steers each in the second experiment which began in January, 1920, and was mainly a comparison between silages made of mature and immature corn and proso. The following table summarizes the main results:

Comparisons of corn varieties and proso for feeding to cattle in the form of silage.

Year and lot.		Nature and composition of silage fed.				Number of steers.	Initial weight per head.	Daily gain per head.	Consumed per pound of gain.	
		Description.	Moisture.	Crude protein.	Crude fiber.				Silage.	Linseed meal.
			Per ct.	*Per ct.*	*Per ct.*		*Pounds*	*Pounds.*	*Pounds.*	*Pounds*
1919 (90 days)	1	Sweet corn	64.0	3.32	7.84	5	864	2.18	25.4	1.16
	2	Early White Dent corn	77.2	2.20	5.78	5	862	2.87	18.5	.88
	3	Rainbow Flint corn	74.8	2.65	5.35	5	862	2.76	23.1	.91
	4	Reed Yellow Dent corn	78.0	2.24	5.51	5	860	2.66	23.6	.95
1920 (120 days)	2	Mature White Dent corn	56.2	5.59	8.63	4	1,008	2.33	27.8	1.22
	3	Immature White Dent corn	87.7	1.69	3.80	4	983	2.09	39.6	1.36
	4	Proso	71.1	1.01	6.10	4	971	1.82	40.8	1.56

When on full feed each steer received 3 lbs. of linseed meal per day in addition to silage. Oat straw was offered during the last 3 months of the 1920 experiment but, although considerable amounts were pulled from the racks by the animals, comparatively little was actually eaten. Lot 1 of the second experiment was fed shelled corn, linseed meal, and wild hay and made an average daily gain of 2.6 lbs. The value of the added gain did not compensate for the greater expense of the ration.

Neither sweet corn nor proso is recommended as a satisfactory silage crop, but the ensiling of immature dent corn is suggested for an emergency. Determinations by B. A. Dunbar of the chemical composition and acidity of the silages fed are tabulated.

Green forage crops and corn for fattening lambs, J. W. HAMMOND (*Ohio Sta. Bul. 340 (1920), pp. 45–99, figs. 21*).—The experiments reported have been noted from two preliminary papers by Hammond (E. S. R., 41, pp. 177, 568). In experiment 2 the lot of lambs grazed on a succession of annual crops were fed for 153 days and not 132, as stated in the first of the papers cited.

Sheep feeding.—IX, Fattening western lambs, 1918–19, J. H. SKINNER and C. M. VESTAL (*Indiana Sta. Bul. 234, pop. ed., (1919), pp. 8, fig. 1*).—The complete bulletin has been noted (E. S. R., 43, p. 375).

The wool of the Sudan, Y. HENRY (*Agron. Colon., 3 (1919), No. 22, pp. 97–108, pls. 2, fig. 1*).—The author describes the variety of wool sheep native to the territory around the Niger River and cites data on wool production in this region. The sheep are of the thin-tailed Barbarine breed. The wool is coarse and is much improved by crossing with Merinos. The sheep receive no feed besides pasture and in the dry season subsist on the roots of aquatic grasses.

Swine production in Delaware, F. A. HAYS (*Delaware Sta. Bul. 124 (1919), pp. 43, figs. 12*).—This bulletin consists of (1) a 14-page discussion of the elements of swine management, (2) data on the cost of wintering brood sows and developing breeding gilts, and (3) the results of 5 experiments in fattening hogs.

The data concerning the gilts consist of the average growth and feed records of 6 individuals for a period of 140 days after weaning. The records of brood sows extended over 2 years, the first experiment beginning in November, 1917, and continuing for 6 months, and the second beginning November, 1918, and continuing 8 months. The sows had free choice of a grain mixture and tankage in a self-feeder. During the first year, when all the sows were Berkshires, they made an average daily gain of 0.33 lb. per head. During the second year, when there were some Yorkshires and Duroc-Jerseys in the herd, the average daily increase was 0.21 lb. Self-feeding is not recommended for brood sows, as they became over-fat and inactive in this experiment and there was a heavy loss of pigs at birth and during the suckling period.

Tomato waste consisting of skins, seeds, and cores discarded in the making of catsup was fed in conjunction with hominy feed and tankage, free choice, to a lot of 5 pigs from September 18 to October 28, 1917. They made an average daily gain of 1.56 lbs. per pig and required 1.9 lbs. of tomato waste, 4.1 lbs. of hominy feed, and 0.19 lb. of tankage per pound of gain. A check lot, not fed tomato waste, gained 1.25 lbs. per day and required 5 lbs. of hominy feed and 0.096 lb. of tankage per pound of gain. The percentage composition of the tomato waste was as follows: Moisture, 88.9; protein, 2.35; ether extract, 1.22; crude fiber, 2.76; nitrogen-free extract, 4.26; and ash, 0.52.

A lot of 6 pigs fed hominy feed and tankage and 4 lbs. of kitchen garbage per head per day for 25 days during October and November, 1917, made an average daily gain of 1.64 lbs. per pig. A second experiment with garbage was conducted later and lasted 80 days. A group of six 80-lb. pigs fed 12.5 lbs. of garbage per head per day and given free choice of shelled corn and a protein supplement made an average daily gain of 1.24 lbs. per head and consumed 10 lbs. of garbage, 1.14 lbs. of corn, 0.09 lb. of tankage, and 0.08 lb. of linseed meal per pound of gain. The tankage was fed during the first 30 days only and linseed meal during the remainder of the period. A second group fed similarly, but with garbage omitted, made an average daily gain of 0.68 lb. and consumed 3.88 lbs. of corn, 0.22 lb. of tankage, and 0.16 lb. of linseed meal per pound of gain.

A study of methods of preparing rye for fattening pigs was made with 5 lots of 5 pigs each for 80 days beginning August 29, 1918. The following table summarizes the methods of feeding the different lots and gives the main results:

Comparison of methods of preparing rye for growing pigs in an 80-day feeding trial.

Lot.	Grain fed.	Initial weight per pig.	Daily gain per pig.	Average ration (free choice).		Consumed per pound of gain.		
				Grain.	Tankage.	Grain.	Tankage.	Total.
		Pounds.	*Pounds.*	*Pounds.*	*Pound.*	*Pounds.*	*Pound.*	*Pounds.*
1	Hominy feed (check)	72.3	1.27	4.6	0.38	3.61	0.30	3.91
2	Whole rye	65.1	.91	4.1	.43	4.49	.47	4.96
3	Soaked whole rye	72.3	.91	4.7	.53	5.13	.58	5.71
4	Ground rye	78.9	1.08	4.4	.35	4.04	.32	4.36
5	Soaked ground rye	72.8	1.14	4.8	.41	4.15	.36	4.51

Grinding but not soaking the grain is recommended as an economical practice.

On September 10, 1918, ten 157-lb. pigs were turned on to a ⅝-acre plat which had been sown broadcast with soy beans in May. They had access to hominy feed and tankage in a self-feeder and exhausted the forage in 40 days, when they had reached an average weight of 228 lbs. The pigs consumed 2.8 lbs. of hominy feed and 0.21 lb. of tankage per pound of gain.

An experiment to study the efficiency of different protein concentrates as supplements to corn was conducted with 6 lots of 140-lb. pigs from February 4 to April 5, 1919. The average daily gains per pig in the lots fed the different supplements were as follows: Corn gluten feed 0.8 lb., tankage 0.93 lb., linseed meal 0.98 lb., soy bean oil meal 1.03 lbs., and coconut oil meal 1.14 lbs. The lot fed exclusively on corn made a daily gain of 0.92 lb.

Swine [feeding experiments], W. E. JOSEPH (*Montana Sta. Rpt. 1919, pp. 23, 24*).—In an experiment to determine the best amounts of tankage to feed to pigs while growing from 35 to 200 lbs., it was found that a relatively large portion of tankage fed toward the beginning of the feeding period resulted in the most rapid and economical gains. In a comparison between two varieties of barley (Blue hull-less, or Guy Mayle, and White Smyrna) when supplemented with tankage and alfalfa hay, it was found that the results obtained with the two rations were substantially the same.

[Work with hogs at the New Jersey Stations], J. M. HUNTER (*New Jersey Stas. Rpt. 1919, pp. 107–114, pl. 1*).—Experiments are presented under four headings, as follows:

I. *Self-feeders v. hand-feeding market pigs on forage crops* (pp. 107, 108).—This is a continuation of experiments previously noted (E. S. R., 41, p. 73). Three lots totaling 29 56-lb. hogs were placed on pasturage (sweet clover and Dwarf Essex rape) July 3, 1918. Each group was fed corn, wheat middlings, and tankage until an average weight of 235 lbs. was attained. Lot 1 was self-fed by the free choice system and reached the required weight October 28 (117 days), making an average daily gain of 1.51 lbs. Lot 2 received a 3 per cent and lot 3 a 2 per cent grain ration during the pasture season (until October 21). Half of each of these lots (sublot A) was self-fed during the finishing period and the other half (sublot B) was finished on a full feed of the rations previously received. The total feeding periods and the average daily gains of these sublots were as follows: 2A, 133 days, 1.27 lbs.; 2B, 154 days, 1.1 lbs.; 3A, 157 days, 1.08 lbs.; and 3B, 176 days, 0.96 lb. There was relatively little difference between the lots in the amount of feed required per unit gain, but the self-fed lot consumed a higher proportion of corn.

II. *Garbage as a hog feed* (pp. 109–112).—Six lots of 10 weanling pigs were fed in this experiment which lasted from June 7, 1918, to January 3, 1919. Lot 1 fed cooked garbage exclusively made an average gain of 165 lbs. and consumed 2.4 lbs. of garbage per pound of gain, while lot 2 fed exclusively on raw garbage gained 189 lbs. and required 2.2 lbs. of feed per pound of gain. Lot 6 fed raw garbage and given access to green forage during the summer gained 170 lbs. per head. Lot 5, the check lot, on a straight grain ration gained 212 lbs. Lot 3 on raw garbage and finished on grain (last 40 days) gained 220 lbs. and lot 4 on raw garbage plus a 1 per cent corn ration throughout gained 258 lbs. Per pound of gain, lot 3 consumed 1.3 lbs. of garbage and 1.3 lbs. of grain; lot 4, 1.6 lbs. of garbage and 1.1 lbs. of grain; lot 5, 4.1 lbs. of grain. No ill effects resulted from feeding the garbage raw, as the pigs had all been given the serum-vaccine treatment early in the experiment.

"Expert meat inspectors from two well-known packing concerns in the East inspected all cuts of meat as the carcasses were split and cut up. While figures

are not given supporting the argument, it may be stated in brief that little or no criticism was offered on any of the carcasses. It so happened, however, that in two instances carcasses which had been fed on cooked garbage were referred to as being a trifle light in color, while two carcasses from the grain fed lot were criticized for lack of firmness and fineness of texture of both fat and muscle tissue."

III. *Pasturing alfalfa during the first season* (pp. 112, 113).—During two summers 8 sows and their litters were carried on a 2.5 acre plat of first year alfalfa, and in addition a considerable amount of hay was harvested. A 3 per cent grain ration was fed.

IV. *Survey of hog farms in New Jersey* (pp. 113, 114).—Data as of March 1, 1918, and March 1, 1919, are tabulated, based upon the replies of 97 farmers to questionnaires calling for information concerning the breeds of hogs kept, numbers of sows, boars, and shotes, the use of self-feeders, tankage, pasture, garbage, etc. Considerable increases in the number of brood sows and young stock between the two dates are noted.

Pork from tomato pomace, V. P. BRAXTON (*Canner, 52 (1921), No. 3, pp. 39, 40, fig. 1*).—Tomato waste (two-thirds seed, the rest skin and cores) from an Indiana tomato pulping factory was ensiled during the canning season and fed the following spring to 70-lb. pigs for 77 days.

A lot of 5 fed an average ration of 6.6 lbs. of the silage and 2.5 lbs. of corn made an average daily gain of 0.92 lb. and gained 20.4 lbs. per bushel of corn fed. A similar lot fed the same ration with the addition of 0.6 lb. of tankage gained 1.13 lbs. per day and made 24.9 lbs. of gain per bushel of corn. A third lot fed tomato silage and corn meal (3:2) made a daily gain of only 0.75 lb. per head.

Barley as a hog feed, P. E. MILLER (*Minnesota Sta., Rpt. Morris Substa., 1919, p. 47*).—A lot of hogs on alfalfa pasture and given free choice of barley, flour middlings, and tankage in a self-feeder selected, respectively, 76.3, 19.9, and 3.8 per cent of the three feeds and made a pound of gain on 3.98 lbs. of grain. A second group in a dry lot required 4.22 lbs. of feed for a pound of gain, and 67 per cent of the ration selected was barley, 26.6 flour middlings, and 6.4 tankage.

Artificial light and egg production, W. F. SCHOPPE (*Montana Sta. Rpt. 1919, pp. 32, 33*).—In an experiment involving the use of 320 White Leghorn pullets, half of which were in pens that were lighted artificially, it was found that the latter produced 42 doz. more eggs than those in the unlighted pens and consumed 282 lbs. more feed. The lighted pens returned greater profits for the year.

Pituitary feeding and egg production in the domestic fowl, S. SIMPSON (*Soc. Expt. Biol. and Med. Proc., 17 (1920), No. 5, pp. 87, 88*).—In experiments with White Leghorn hens, the author failed to confirm the conclusion of Clark (E. S. R., 34, p. 75) that feeding anterior lobe of the pituitary gland (ox and growing calf) increases egg production. The tests were conducted at different times in the summer, winter, and spring, and the dosage was at first the same as that used by Clark and later doubled and trebled.

How eggs are graded and why, MR. and MRS. G. R. SHOUP (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 8, pp. 119–121, fig. 1*).—This popular article includes a description of a simple homemade device for grading eggs by weight.

Effect of rations upon the hatchability of eggs, W. J. BUSS (*Mo. Bul. Ohio Sta., 5 (1920), No. 10, pp. 262–266*).—The hatching data secured in a course of three of the long-term experiments at the station are summarized.

Studies of various amounts of protein were made each year from 1916 to 1920 with 3 lots of hens receiving, respectively, 1, 6, and 11 parts of meat scrap per 15 parts of mash. The corresponding 6-year averages of the percentages of fertile eggs hatched were 70.7, 67, and 70.1. In another set of experiments carried on from 1915 to 1920 a comparison was made between simple and varied rations. In the simplest ration corn was fed as a scratch feed and ground corn and meat scrap (8:5) as a mash. The average hatching percentage in this lot was 72. In a slightly more complex ration in which the mash was composed of ground corn, bran, and meat scrap (7:3:5) the hatching percentage averaged 71.4. In a similar ration with four parts of tankage substituted for the meat scrap the average hatching percentage was 67.4. With complex ration in which corn, wheat, and oats were fed as a scratch feed and corn, bran, middlings, linseed meal, and meat scrap as a mash the hatching percentage averaged 69.5. In a 3-year comparison, 1915–1917, between the eggs laid by hens on range and the eggs laid in confinement, it was found that 65.6 per cent of the former and 61.6 per cent of the latter hatched.

It is concluded that a greater percentage of fertile eggs are hatched when simple, well balanced rations containing considerable amounts of corn are used and the birds are not too much confined.

Incubation problems, H. R. Lewis (*New Jersey Stas. Rpt. 1919, pp. 127, 128*).—Preliminary results are given of some studies of the influence of moisture during incubation upon hatching percentages. The percentages of eggs hatched and the weights of the chicks were greater when moisture was supplied in trays throughout the incubation period. Production records from the Vineland egg-laying contest are cited to show that there is no clear relationship between hatching percentages and the number of eggs laid by a bird.

Seasonal price variations for poultry products at the New York market, H. R. Lewis (*New Jersey Stas. Rpt. 1919, pp. 137, 138*).—The monthly prices of various grades of eggs, dressed poultry, and live poultry from July, 1918, to June, 1919, are tabulated.

Rabbit feeding, W. F. Schoppe (*Montana Sta. Rpt. 1919, p. 33*).—Some determinations of the dressing percentages of rabbits are reported. At 10 weeks of age the percentages ranged from 50.4 to 63.4, at 14 weeks from 40.7 to 55.7, at 18 weeks from 42 to 48.9, and at 22 weeks from 38.6 to 42.4. The percentage of bone ranged from 4.9 to 6.3.

The rabbit book, F. L. Washburn (*Philadelphia and London: J. B. Lippincott Co., 1920, pp. 200, pl. 1, figs. 83*).—This book aims to be a practical manual on the care of Belgian hares, Flemish Giants, and other utility rabbits. Advice on purchasing breeding stock, construction and management of a rabbitry, feeding, breeding, the control of disease, selling, shipping, and exhibiting rabbits, killing and dressing for the table, creating a market for rabbit meat, cooking rabbit meat, and the preparation and marketing of skins are included.

DAIRY FARMING—DAIRYING.

Sunflowers v. corn for silage, E. L. Anthony and H. O. Henderson (*West Virginia Sta. Circ. 32 (1920), pp. 8, fig. 1*).—To compare sunflower silage and corn silage 2 groups of 5 dairy cows were fed by the reversal method during two 3-week periods. The group changed from sunflower silage to corn silage showed an average decrease of 5.8 per cent in the milk in the second period, while the group receiving sunflower silage last showed a decrease of 13.5 per cent. There was also a slightly greater decrease in the fat production of the

second group. Although this preliminary trial indicates that sunflower silage is slightly inferior to corn silage in maintaining milk flow, the growing of sunflowers for silage is recommended in sections of West Virginia where the tillable acreage is limited, because of the much larger tonnage per acre. Proximate analyses by H. H. Hanson of silages made from sunflowers cut at different stages are included.

Sunflower ensilage for milk production (*Agr. Gaz. Canada, 7 (1920), No. 10, pp. 818, 819*).—In an experiment conducted at the Manitoba Agricultural College during the winter of 1919–20, ensiled sunflowers cut in the dough stage were fed to 7 dairy cows during a 4-week period. The production records are not given, but it is stated that the milk flow was about equal to the average of the preceding and following periods when corn silage was fed. The sunflower silage contained 16 per cent more moisture than the corn silage, and the possibility of its freezing when fed out of doors is pointed out. Since the sunflower matures much better than corn in Manitoba, its utilization for silage is advocated.

[Influence of the use of legume hay on the cost of milk production], J. B. Bain (*Md. Agr. Soc. Rpt., 4 (1919), pp. 203–206*).—Data secured in cost of production studies by the Dairy Division, U. S. Department of Agriculture, during two years in Indiana and Vermont are cited. When herds composed of cows of the same average productivity were compared it was found in each case that less grain was consumed per 100 lbs. of milk where legume hays were fed liberally than where nonlegume roughages were used mainly or exclusively.

A study of the cost of milk production, F. App (*New Jersey Stas. Rpt. 1919, p. 299*).—A table is presented of the itemized cost of keeping a dairy cow for a year, using the 1918 scale of prices and the feed consumption and labor data given in Bulletin 320 (E. S. R., 40, p. 473) for the special group of 160 dairy farms in Sussex County. The net cost per cow is estimated at $27.69 and the cost of producing 1 qt. of milk 7.31 cts.

How can skim milk be best supplemented for calf raising? F. Honcamp, F. Dettweiler, et al. (*Ber. Landw. Reichsamte Innern, No. 41 (1919), pp. 183, pls. 18*).—This is a report of cooperative calf feeding studies on seven large estates conducted under the supervision of various research institutions before the outbreak of the European war. In each case there was a whole milk group of calves and a skim milk group designated as lot A and lot B, respectively. The calves were mostly 3 weeks old at the beginning, and the experiments continued for 20 weeks. Skim milk was offered to lots B at the beginning of the sixth week along with ground oats and flaxseed, while whole milk feeding was discontinued with this group during the eleventh week. Skim milk, oat meal, and flaxseed were offered to lots A at the eleventh week. No whole milk was given lots A after the seventeenth week, at which time peanut cake was offered to both groups. Hay was fed to all the calves, beginning on a small scale with the sixth week. The detailed data include feed consumption, weights, and the measurements of 8 body dimensions at frequent intervals. Simmental and black and white Lowland calves were included.

The lot B calves averaged 90 per cent of the gain of lot A at a lower cost per unit of body weight, and were in a good state of development at the end of the experiments. It is concluded, therefore, that the method of supplementing skim milk used for lots B is entirely satisfactory.

The milk supply of Rouen and Seine-Inférieure, A. Guillaume (*Le Lait a Rouen et en Seine-Inférieure. Lons-le-Saunier: Lucien Declume, 1919, pp. [4]+XIII+143, figs. 7*).—This pamphlet deals with the market milk industry in Seine-Inférieure, and the healthfulness and the chemical composition of the

milk supplied to Rouen during the war. The method of milk control has been noted from another source (E. S. R., 43, p. 271).

The development of acidity in milk, D. W. Steuart (*Jour. Dairy Sci., 3 (1920), No. 1, pp. 52–59*).—The author reports studies on acid production in milk in Wales. The high acidity developed on incubation at 98° F. indicated the universal presence of lactobacilli. Yeast, molds and sport-forming rods were found to reduce the acidity in such cultures.

Elimination of germs from dairy utensils, (1) by rinsing, (2) by drying in sun and air, M. J. Prucha and H. A. Harding (*Illinois Sta. Bul. 230 (1920), pp. 139–168*).—Two series of experiments are reported. In the first a total of 449 milk cans washed in the ordinary way in a creamery were rinsed with measured amounts (1 to 9 qts.) of water at temperatures of 70, 150, or about 205° F. In the second series 213 milk cans and 58 milk pails, after being washed and rinsed, were inverted on a rack at 8 a. m. and kept exposed to sun and air for either 8 or 20 hours, direct sunlight not being permitted to penetrate to the interior. The number of bacteria recovered from a liter of water, shaken about in the utensil after the experimental treatment, was used to estimate the bacteria removed by the rinsing or drying process and the number which would have been added to the milk if the cans had been put at once into use. The tables include bacterial counts for each can and pail used in the experiments.

From the results of the rinsing experiments, it is concluded that a considerable part of the reduction in the germ content of the cans was due to the mechanical removal of bacteria by the rinsing water, the water at 70° removing an average of more than 2 billions of living germs per can. With temperatures of 200° or more the number of living germs removed averaged less than half a billion per can, but the germ content of the can after rinsing was greatly reduced so that in favorable cases it is estimated that use of cans thus rinsed would not add more than 100 bacteria per cubic centimeter to the milk. It was found that hot wash water, particularly if used in small amounts and poured from can to can, rapidly loses its heat and that too much reliance must not be placed upon the germicidal action of such rinse water.

The number of bacteria in the cans dried for 8 hours varied from 10,000 to 103,000,000. Seventeen per cent of the cans and 10 per cent of the pails had less than 100,000 bacteria, and 64 per cent of the cans and 76 per cent of the pails more than 1,000,000 bacteria. It is estimated that 26 per cent of the cans would have added less than 10 bacteria per cubic centimeter to milk, 25 per cent between 10 and 100 bacteria, and 13 per cent more than 1,000 bacteria. The average contamination by these cans would have been 385 bacteria per cubic centimeter of milk and by the pails at their first filling with milk 848 bacteria. In many cases the longer exposure of the cans did not result in greater destruction of bacteria, due to rains or high humidity.

In a supplemental experiment 10 cc. of water (of known bacterial content) taken from vats in which milk utensils had been cleaned was added to each of 48 8-gal. cans that had been thoroughly steamed, dried, and cooled. The added liquid was distributed over the inner surface by vigorous shaking and the cans, half of them covered, were held for 24 hours at about 70°. It is estimated that the covered cans would have added an average of 247,772 bacteria per cubic centimeter to milk and that the open cans would have added only 1,284.

How do bacteria get into milk at the farm and how may their number be reduced? M. J. Prucha, H. A. Harding, H. M. Weeter, and W. H. Chambers (*Jour. Dairy Sci., 3 (1920), No. 4, pp. 308–313*).—This is an historical note with a brief bibliography, showing the development of the view that dairy

utensils and not the construction of the barn, the air, or the ordinary routine practices at the barn are the chief sources of bacteria found in milk. The experiments noted above are summarized.

Experiments with and practical application of heat sterilization for all parts of milking machines, G. H. Hart and W. H. Stabler (*Jour. Dairy Sci., 3 (1920), No. 1, pp. 33–51*).—The authors give the full details of the two experiments previously noted from a preliminary paper by Hart (E. S. R., 42, p. 564), showing that rubber tubing causes rapid deterioration of chlorin solutions used for sterilizing milking machine parts, and report success in reducing the bacterial counts of machine-drawn milk produced on three California ranches by the use of hot water. The parts, after washing, are placed in water in a covered galvanized iron tank. Steam is run into the tank until the temperature is 180° F., and the parts are not removed for at least 15 minutes. There were indications that the life of the rubber tubes was prolonged if they were kept wet after such sterilization.

It is suggested that the outbreaks of mammitis common in herds where milking machines are used may be due to infection of the udder with pyogenic cocci by unsterile teat cups.

Dairy produce factory premises and manufacturing processes, L. T. MacInnes and H. H. Randell (*Agr. Gaz. N. S. Wales, 31 (1920), Nos. 4, pp. 255–264, pls. 4; 5, pp. 333–337, pls. 4; 7, pp. 485–489, pls. 4; 8, pp. 563–566, pls. 4, fig. 1*).—The authors made bacteriological investigations of the air, water supply, equipment, etc., of three Australian creameries where difficulties occurred in producing butter of good keeping quality despite adequate pasteurization of the cream.

The first creamery was old, poorly constructed, and badly in need of repair. Contamination was found to occur through the holding of the pasteurized cream in open vats exposed to dust from overhead obstructions and air laden with enough bacteria to add half a million per cubic centimeter in 20 hours. The system of working and salting the butter in an open worker facilitated the inclusion of many bacteria, molds (including *Oïdium lactis*), and yeasts.

The second factory was also old but in a better state of repair, and the walls and ceiling had been freshly whitewashed. The chief source of trouble was found to be the use of high-acid unpasteurized cream as a starter. In the third case contamination of the butter by the wash water occurred.

For the purpose of comparison a description is given of the most modern and best equipped creamery in New South Wales. Bacteriological studies revealed almost ideal sanitary conditions, and the butter was of excellent quality.

Faults found in butter, A. M. Brown (*Agr. Gaz. N. S. Wales, 31 (1920), Nos. 7, pp. 490–494; 8, pp. 591–594*).—The author defines the following faulty flavors in butter and suggests causes and remedies: Tallowy, unclean, fishy, rancid, overneutralized, sour, cheesy, cooked, moldy, woody, and oxidized.

Pink discoloration of cheese, G. H. Mason (*Jour. Min. Agr. [London], 27 (1920), No. 6, pp. 520–522*).—A pink discoloration which developed on the surface and cracks of Wensleydale cheese sent to University College, Reading, for investigation was found to be due to an unidentified yeast.

Factory cheese making, B. van der Burg and S. Hepkema (*De Kaasbereiding aan de Fabriek. The Hague: Alg. Nederland. Zuivelbond, 1920, pp. [4]+232, figs. 67*).—This treatise is mainly devoted to the manufacture of Gouda and Edam cheese, but directions for making Friesian clove cheese, Leiden cheese, full-fat and half-fat Cheddar, and half-fat Cheshire are included. Besides the detailed directions there are chapters on microorganisms in cheese.

judging and testing cheese, cheese factory bookkeeping, cheese control, and the methods of sampling and making chemical examination of milk and cheese.

Condensed milk and milk powder, O. F. Hunziker (*La Grange, Ill.: Author, 1920, 3. ed., rev. and enl., pp. 383, figs. 111*).—In preparing a new edition of this treatise (E. S. R., 40, p. 283) the author has added chapters on the standardization of the sterilizing process, evaporated-milk control, use of the Mojonnier viscosimeter, manufacture of condensed buttermilk and buttermilk powder, and new patents and processes for the manufacture of milk powder. The discussions of the standardization of condensed milk and the prevention of defects in condensed milk and milk powder have been revised, and new data are included on markets, exports, imports, and cost of manufacture.

VETERINARY MEDICINE.

The pathogenic protozoa and the diseases which they cause, including an introduction to general protozoology, M. Hartmann and C. Schilling (*Die Pathogenen Protozoen und die Durch sie Verursachten Krankheiten Zugleich eine Einführung in die Allgemeine Protozoenkunde. Berlin: Julius Springer, 1917, pp. X+462, figs. 337*).—This is a textbook intended for use by students of medicine and of zoology. The first or general part (pp. 3–134) covers general morphology and physiology; ecology, including the interrelations of parasite and host and general pathogenesis; and a systematic consideration and the general technique of protozoal investigations. The second or special part deals, respectively, with the entamœbæ, parasitic and pathogenic flagellates, the pathogenic binucleates and the diseases they cause, spirochetes and spirochetoses, pathogenic Myxosporidia, pathogenic Microsporidia, pathogenic Haplosporidia, Sarcosporidia, the pathogenic Coccidia, and pathogenic ciliate Infusoria.

A classified bibliography of 30 pages and author and subject indexes are included.

A compend of veterinary medical diagnosis, A. Monvoisin (*Précis de Diagnostic Médical. Paris: Asselin and Houzeau, 1919, pp. VII+404, pls. 3, figs. 193*).—This is a handbook on diagnosis intended for use by students and practitioners of veterinary medicine. A glossary of technical words is appended.

Preparation and shipment of specimens for laboratory diagnosis, H. F. Lienhardt (*Kansas Sta. Circ. 83 (1920), pp. 11*).—Directions are here given for the preparation and shipment of specimens where a diagnosis of disease in animals is desired. The text of the traffic rules and instructions and postal laws and regulations relating to diseased tissues are appended.

French research on gas gangrene, E. Sacquépée (*Lancet [London], 1920, II, No. 12, French Sup., pp. 605, 606*).—This paper describes briefly pathogenic and therapeutic studies of gas gangrene made in France during the European war.

The three organisms considered by the author to be most frequently associated with gas gangrene are *Bacillus perfringens*, *Vibrion septique*, and *B. bellonensis* (possibly identical with *B. œdematiens*). The preparation of specific serums is outlined, and the results are reported of their use as both curative and preventive agents. Of 191 cases of gangrene treated with active serums against the three organisms there were 166 cures and 25 deaths, or a mortality of 13.09 per cent, against an average mortality of 75 per cent in untreated cases in the same region. Of 319 cases of severe wounds treated preventively, only 4 cases of gas gangrene occurred.

The diagnosis of bacteriological types of gas gangrene, de Lavergne (*Lancet [London], 1920, II, No. 12, French Sup., pp. 607, 608*).—The author describes the use of specific serums as a rapid method of determining which of

the three organisms mentioned in the above paper are involved in a given case of gas gangrene. The method consists briefly in inoculating a series of three guinea pigs simultaneously with an emulsion of fragments of the wound and one of the three specific serums. A fourth animal is inoculated with the emulsion alone, and a fifth with the emulsion and a mixture of the three serums. Diagnosis is said to be fairly clear after 12 hours and positive after 24 hours. In case of infection with a single organism two animals survive, the one receiving a single serum and the one receiving the mixed serum. With a mixed infection of two of the organisms, the animal protected by the three serums alone remains unharmed, while the animals receiving the one or the other of the two organisms involved will show important local lesions.

In the rare cases in which all the animals succumb the conclusion is drawn that the gangrene is due to some organism other than *Bacillus perfringens*, *B. bellonensis*, or *Vibrion septique*. In the practice of the author about 60 per cent of the cases examined have proved to be due to one of these three organisms, about 35 per cent to double infection, and 4 or 5 per cent to other causes. This method of diagnosis is said to give results which parallel those obtained by the usual bacteriological methods, and to have the advantage of being much more rapid of execution.

The action of adrenalin on the heart, I–III, W. J. R. HEINEKAMP (*Jour. Pharmacol. and Expt. Ther., 14 (1919), Nos. 1, pp. 17–24, figs. 4; 4, pp. 327–342, figs. 7; 16 (1920), No. 4, pp. 247–257, figs. 4*).—These papers deal, respectively, with the action of adrenalin on the turtle heart, the modification of the action of adrenalin by morphin, and the modification of the action of adrenalin by chloroform.

"Adrenalin exerts a direct action on the cardio inhibitory center of the turtle, stimulating it and hence producing stoppage of the heart. Due to central anemia, fatigue, or tolerance being established, adrenalin exerts no action after repeated use. Adrenalin when injected directly into the heart muscle acts as a stimulant, increasing both rate and amplitude, systole being most affected. Strychnin exerts some action on the medulla which produces partial inhibition. (This needs further investigation). Adrenalin is not any more efficacious after strychnin than before.

"Adrenalin has a direct central action and is synergistic with morphin. Morphin to a degree sensitizes the vagus center. The aggravated adrenalin action following morphin is due to the morphin sensitization and adrenalin-morphin synergism. The increased blood pressure plays but a little part in effecting the inhibition of the heart.

"Chloroform is toxic for heart muscle, producing or tending to produce weakening of the organ. Inhibition under chloroform anesthesia after adrenalin is due primarily to the toxic or paralytic dilation of the heart, ventricular fabrillation supervening on this condition. Because of the action of chloroform on the heart, adrenalin is contraindicated wherever chloroform is employed and chloroform wherever adrenalin is used. The blood pressure has no definite reflex relation to the production of the condition of paralytic dilatation, but has a most important direct action by preventing the ventricle from emptying itself. The adrenalin action is peripheral since it occurs after section of the vagi."

Serological relationships of liver and kidney, M. S. FLEISHER, T. G. HALL, and N. ARNSTEIN (*Jour. Immunol., 5 (1920), No. 5, pp. 437–453*).—"By means of complement fixation reactions and absorption of sera prepared against guinea pig liver and kidney, we have been able to show that there exists a definite relationship between the antiorgan sera and the homologous antigens. The antigens and antisera are not simple, but are complex in nature, and probably are composed of several different partial antigens and immune bodies. Pos-

sibly these partial antigens and antibodies can be arranged in three groups: The first having a very wide range of activity and having a relationship to all or practically all tissues of the species; the second having a limited range of activity and having relationship only with the tissue used in the preparation of the antiserum; and the third being possibly a group of antibodies, also rather limited in their range of activity but reacting only or more strongly with individual tissues other than the one used as the immunizing substance."

Influence of variations of media on acid production by streptococci, F. S. Jones (*Jour. Expt. Med., 32 (1920), No. 3, pp. 273–281, figs. 2*).—Determinations of acid production by various streptococci in 1 per cent dextrose (fermented and unfermented) veal broth modified by the addition of 4 per cent of horse serum are reported in terms of H-ion concentration and of titratable acidity.

Human and bovine streptococci and a group of low acid-producing streptococci from milk produced less acid in the simpler broths (fermented and unfermented) than in the broths enriched by either serum or peptone. The equine streptococci, on the other hand, produced less acid in the serum medium. The average minimum and maximum acid production obtained with the various streptococci under the conditions of the experiment were as follows: Human, pH 4.97 to 5.66, titratable acidity, 4.51 to 3.66; bovine, pH 4.56 to 4.77, titratable acidity, 7.0 to 5.74; equine, pH 4.86 to 5.42, titratable acidity, 5.38 to 4.24; and low acid-producing streptococci from milk, pH 6.28 to 5.14, titratable acidity, 2.56 to 4.28.

The author is of the opinion that the differences in titratable acidity, even in the presence of buffer substances, are as marked as the differences in H-ion concentration.

The use of ultraviolet light in the preparation of vaccines, R. Lanzillotta (*Ann. Ig. [Rome], 30 (1920), No. 5, pp. 245–250*).—From a limited number of immunization experiments, conducted upon guinea pigs with cultures of typhoid and chicken cholera bacilli subjected for 20 minutes to the action of ultraviolet light or to the vapor of chloroform, the author concludes that such treatment, while rendering the cultures inocuous, does not destroy their immunizing power.

The protective value of pneumococcus vaccination in mice and rabbits, A. B. Wadsworth (*Jour. Immunol., 5 (1920), No. 5, pp. 429–435*).—In a series of experiments on attempted immunization of mice and rabbits against pneumococcus of types I, II, and III, definite protection was obtained against the development of the homologous types of infection when large doses of vaccine were used. It is pointed out that the protection is not great considering the amount of vaccine used, and that this further illustrates the parasitism of such highly virulent cultures as has been previously noted (E. S. R., 40, p. 480).

The Acanthocephala of domestic animals, A. Railliet (*Rec. Méd. Vét., 95 (1919), No. 7, pp. 185–198*).—This general account contains a review of the literature, and gives a classification of the three families of the Acanthocephala (Neœchinorhynchidæ, Echinorhynchidæ, and Gigantorhynchidæ).

On the classification of the Ascaridæ, I, H. A. Baylis (*Parasitology, 12 (1920), No. 3, pp. 253–264, fig. 1*).—This first paper deals with the systematic value of certain characters of the alimentary canal.

Anthrax, J. Bagué (*Porto Rico Dept. Agr. and Labor Sta. Cir. 26 (1920), Spanish ed., pp. 11, figs. 3*).—This is a brief popular account of anthrax, with control measures.

Symptomatic anthrax; treatment and cure with the serum of Leclainche and Vallée, C. Mazières and Pécard (*Rev. Gén. Méd. Vét., 29 (1920), No. 344, pp. 422–424*).—The authors report the successful use of the antiblackleg serum of Leclainche and Vallée in the treatment of blackleg in a heifer. The treat-

ment consisted in the intravenous injection of 60 cc. of the antiblackleg serum, followed two hours later by a second injection of 40 cc., and at intervals of two hours six other injections of 20 cc. each. A large crepitant tumor on the shoulder was also cauterized twice. Slight improvement was noted on the eleventh day, with practically a complete cure in 20 days.

Importance of preparedness in meeting future outbreaks of foot-and-mouth disease, J. R. MOHLER (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 5, pp. 579–587*).

The prevention and treatment of foot-and-mouth disease by the serum or the blood of cured animals, C. LEBAILLY (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 12, pp. 555, 556*).—The author has been able to secure transient immunity against foot-and-mouth disease by the intravenous injection of serum or blood obtained from animals recently recovered from severe attacks of the disease. In the prophylaxis of the disease, a marked attenuation of the symptoms has been noted in cases in which the treatment has been given early in the disease. Methods employed in the preparation of the serum or blood are described in detail.

Chronic emphysema of the lungs following foot-and-mouth disease, K. R. KUIPERS (*Tijdschr. Diergeneesk., 46 (1919), No. 21, pp. 647–649; abs. in Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 5, pp. 605–607*).—Permanent affections of the udder and deformities of the feet frequently follow outbreaks of foot-and-mouth disease, and in addition to these, chronic emphysema of the lungs is a serious and frequent sequel.

The number of emphysematous cattle is small among those that have been treated with serum immediately on the first appearance of the disease, indicating that there is a relationship between the affection of the lungs and the virus of foot-and-mouth disease. In the author's practice, there are herds of cattle in which more than half of the animals are affected with emphysema of the lungs. In the 1911 epizootic, the author observed that those cattle suffering from emphysema following foot-and-mouth disease were able to transmit the latter disease for months.

The diagnosis of rabies in animals: A statistical study of the records of the Hygienic Laboratory for the period 1909 to 1919, H. E. HASSELTINE (*Pub. Health Rpts. [U. S.], 34 (1919), No. 43, pp. 2378–2388*).—Of 1,003 specimens examined by the Hygienic Laboratory from February 1, 1909, to April 30, 1919, 588 gave evidence of rabies and 415 gave negative results. Of 389 specimens submitted to both microscopical and animal inoculation tests, the microscopic finding was confirmed in 91.3 per cent of the cases. Of 406 specimens inoculated into animals there were 79 positive results, the average inoculation period being 16.2 days. The colder months of the year furnished the greatest number of specimens and the greatest percentage of positive findings.

Sarcoptic scabies in man and animals, C. WARBURTON (*Parasitology, 12 (1920), No. 3, pp. 265–300, pl. 1, figs. 10*).—This is a critical survey of the present knowledge of the acari concerned.

Contribution to the study of Trypanosoma venezuelense Mesnil, M. LEGER and E. TEJERA (*Bul. Soc. Path. Exot., 13 (1920), No. 7, pp. 576–588*).—Comparative studies made of the morphology, therapeutic action of drugs, relative immunity, etc., of *T. venezuelense* and *T. evansi* have shown them to represent distinct species.

The complement fixation test in pulmonary tuberculosis: Its use as a means of diagnosis, A. L. PUNCH (*Lancet [London], 1920, II, No. 13, pp. 647–651, 652*).—From the investigation reported, which dealt only with the application of the test to pulmonary tuberculosis, the conclusions were drawn "that

in the complement fixation test we have a specific means of diagnosis of the presence of an active or recently active tuberculous lesion; that a negative reaction is as reliable an indication of the absence of such a lesion as a positive reaction is of its presence; and that a positive reaction in the highest dilution only of complement is just as reliable an indication of the presence of such a lesion as a positive reaction in all three dilutions."

Tuberculosis control, C. C. Georgeson and H. E. Pratt (*Alaska Stas. Rpt. 1918, pp. 19, 20, 89, fig. 1*).—Tests made in September, 1917, of that part of the herd which was found the previous year to be free from tuberculosis resulted in the reaction of but two animals. One of the two, the Galloway herd bull, was killed and, notwithstanding the fact that he had appeared to be strong, active, and in perfect health, his carcass was condemned because of the advanced stage of the disease. The other, a registered Holstein cow, was transferred to that part of the herd which had reacted the previous year and been isolated at Kalsin Bay. All nine of the yearlings which had been raised from the tubercular cattle, having been removed from their dams at birth and fed on pasteurized milk from the tubercular cows, were tested and found to be free from the disease.

Further investigations on the bacterial content of the flesh of normal slaughterhouse animals, Bugge and Kiessig (*Ztschr. Fleisch. u. Milchhyg., 30 (1919), Nos. 2, pp. 17–20; 3, pp. 34–38; 4, pp. 53–56*).—This is a continuation of the study of bacterial infection in slaughterhouse animals previously noted (E. S. R., 26, p. 660), in which the method of Conradi (E. S. R., 22, p. 183) was employed.

The additional tests here reported indicate that a considerable percentage of the flesh of healthy normal animals, obtained and examined under the most sterile conditions possible, contains bacteria. If organisms of different kinds are found in the flesh of the same animal postmortem contamination is indicated, while if the same organism is found in different parts of the same animal an infection of the apparently sound living animal is indicated.

[Normal range of temperature in cattle], H. Welch (*Montana Sta. Rpt. 1919, p. 33*).—In order to determine the range of temperature in normal cattle, six daily temperatures were taken in a herd of 28 cows for a period of 30 days in December. A greater range was found in the normal temperature of cattle than is generally recognized.

The dipping of sheep in so-called carbolic dips, A. Stead (*Union So. Africa, Dept. Agr. Jour., 1 (1920), No. 6, pp. 536–547*).—In this discussion attention is called to the risk that may attend the practice of dipping in so-called carbolic dips. While dips sold as nonpoisonous may not be poisonous when some waters are used, they may be when other waters are used. "The most dangerous water would appear to be that which is moderately hard, because the oily globules separated under these conditions are very tiny and easily overlooked."

The limbs of the horse, O. C. Bradley (*Edinburgh: W. Green & Son, Ltd., 1920, pp. XI+172, figs. 115*).—The several parts of this work, the figures of which are nearly all in colors, deal with the thoracic limb, the hoof and its contents, the arteries of the thoracic limb, the nerve and blood supply of the muscles of the thoracic limb, the pelvic limb, the arteries of the pelvic limb, and the nerve and blood supply of the muscles of the pelvic limb. An index is included.

Hairless pigs, P. E. Miller (*Minnesota Sta., Morris Substa., Rpt. 1919, pp. 45, 46*).—It is stated that about 75 per cent of the spring litters of pigs were hairless, some having been all hairless and other litters only partly so. This is said to have been the first occurrence of the disease in the station herd.

Notes on a micrococcus isolated from cases of broncho-pneumonia (so-called "flu") of swine, C. Murray (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 5, pp. 539–542*).—"A small Gram-negative micrococcus has been isolated with marked regularity from a number of swine suffering from broncho-pneumonia, so-called 'flu.' Intravenous injection of large doses of the organism into swine and intraperitoneal injection into rabbits and guinea pigs have caused death from acute septicemia. Similar injections of smaller quantity of culture produce the disease, running a typical course. The pathological changes in animals thus killed resemble very closely those found in swine dying from a natural infection. Serological tests indicate that agglutinins for the micrococcus are present in the blood of affected and recovered animals in low dilutions, and that by systematic immunization these agglutinins may be markedly increased."

Strongylus rubidus as an etiological factor in gastric lesions of hogs, W. J. Crocker and H. E. Biester (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 5, pp. 527–538, figs. 2*).—"*S. rubidus* can produce severe gastric lesions and systematic disturbances, resulting in death, when a primary disease process is present which lowers the vitality of the stomach mucous membrane. Very slight broncho-pneumonia, due either to *S. paradoxus* or *Bacillus suisepticus*, may constitute the primary debilitating factor. *S. rubidus* can produce heavy catarrhal exudate and small ulcerations of the gastric folds, which can be determined microscopically. The distribution of pneumonic areas was not sufficiently widespread to induce death by pneumonia and septicemia."

It is stated that in post-mortem examinations at the West Philadelphia abattoir of about 400 pigs, all of which had passed the ante-mortem inspection and were apparently healthy, 60 per cent were found to be infested with *S. rubidus*. The post-mortem evidence seems to indicate that the pneumonia caused by *B. suisepticus* is the primary cause which is instrumental in reducing the vitality of the stomach mucous membrane, and thus permits *S. rubidus* to become actively engaged in invading the stomach mucosa.

The contagious epitheliosis problem, H. R. Lewis (*New Jersey Stas. Rpt. 1919, pp. 133–137*).—The serious outbreaks of chicken pox, roup, and canker in New Jersey are said to have warranted the recognition of the control of this disease in its three forms as perhaps the most important problem with which poultry keepers in the State have to deal. A popular summary is given of knowledge of the disease and means for its control.

A vaccine was prepared during the spring and tried on 1,000 birds distributed among five different flocks in various parts of the State. All the flocks were visited by the disease, and from 10 to 50 per cent of the birds showed symptoms of the affection. In these cases the vaccine was used primarily as a treatment after the outbreak had been noted. During the fall a large cooperative experiment was also conducted on about 40 farms for the purpose of determining the value of the vaccine as a preventive measure against chicken pox, roup, and canker.

Limberneck in poultry, S. D. Wilkins and R. A. Dutcher (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 6, pp. 653–685, figs. 9*).—Investigations conducted by the authors at the University Farm, St. Paul, Minn., have led to the following conclusions:

"Limberneck symptoms are not comparable to the symptoms in polyneuritis brought about by dietary deficiencies. Limberneck is undoubtedly a symptom rather than a disease.

"It was possible to produce limberneck symptoms in poultry by feeding and injecting the toxins produced by three different strains of *Bacillus botulinus*.

The strains were toxic, however, to guinea pigs. Symptoms of botulinus poisoning in chickens differed markedly from limberneck symptoms.

"It was impossible to produce limberneck symptoms by feeding common salt, paint skins (lead poisoning), smut, or spoiled meat.

"Larvæ which developed from eggs (from *Calliphora vomitoria*, *Musca domestica*, and *Lucilia cæsar*) laid upon fresh beef were not toxic when fed to chickens. No limberneck symptoms were observed when larvæ were fed which had developed from eggs laid by *C. vomitoria* and *M. domestica* upon limberneck carcasses. Limberneck symptoms were obtained by feeding larvæ of *L. cæsar* which had developed from eggs laid upon limberneck carcasses.

"Adequate diets do not protect against limberneck in poultry. The body temperature of chickens falls below normal in botulinus poisoning and in polyneuritis (avian beri-beri), but this was not observed to be the case in 'limberneck chickens.'"

A list is given of 36 references to the literature.

Rose-chafer poisoning in chickens, B. A. Gallagher (*Jour. Amer. Vet. Med. Assoc., 57 (1920), No. 6, pp. 692–695*).—This is a brief summary of information on the poisoning of chickens that results from eating rose chafers, an account of which by Lamson has been noted (E. S. R., 35, p. 489).

A report of the toxicity of this beetle when ingested by brook trout, by Bates, has also been noted (E. S. R., 35, p. 279).

A contribution to our knowledge of the tapeworms of poultry, F. J. Meggitt (*Parasitology, 12 (1920), No. 3, pp. 301–309, pl. 1, figs. 5*).—The species here dealt with are *Cotugnia digonophora* (Pasq.), *C. brotogerys* Meggitt, *C. fastigata* n. sp., *Hymenolepis columbæ* (Zed.), *H. coronula* (Duj.), and *H. gracilis* (Zed.).

Contribution to the knowledge of Syngamus bronchialis, W. Feuereissen (*Ztschr. Fleisch u. Milchhyg., 27 (1916), No. 2, pp. 17–22, figs 7*).—The author first reviews the literature relating to this nematode parasite of the goose, and reports studies based upon post-mortem examinations made of infested geese. Post-mortem examinations were made of young geese from a flock of 25, all of which had been sick after having been in a muddy village pond. The symptoms consisted of dyspnea, lack of appetite, and weakness. The head, which was held high with the bill open, shook, and a rattling noise was heard. In the post-mortem examination of the goose first sent in numerous strongylids were found in the trachea and the bronchi; 11 were taken from the trachea, and a total of 72 were removed. The lungs showed all the changes of croupous pneumonia in the stage of red hepatization.

A technical description of the parasite, notes on its biology, and a list of nine references to the literature are given.

RURAL ENGINEERING.

Proceedings of the thirty-second annual meeting Iowa Engineering Society, held at Fort Dodge, Iowa, February 17–19, 1920 (*Iowa Engin. Soc. Proc., 32 (1920), pp. 198, pl. 1, figs. 6*).—These proceedings contain the following special articles: Drainage Assessments, by G. R. Boyd; Division of Benefit Assessments in Large Drainage Districts, by H. D. Keerl; Practical Points for Drainage Engineers: Minnesota's Drainage Problems, by E. V. Willard; State Supervision of Drainage Work from the Contractor's Viewpoint, by J. W. Boyer; Capacities for which Tile Mains should be Designed, by J. L. Parsons; Methods of Construction and Engineering Inspection on the Country Pavement between Waterloo and Cedar Falls, by E. A. Zack and C. M. Fisher;

Trucks and Our Pavements, by M. L. Patzig; and Recent Developments in Brick Pavement Construction, by T. R. Agg.

Protocol of the sixteenth conference of the Swiss official agricultural engineers at Lausanne, August 28–31, 1919 (*Protocole Ingén. Ruraux Conf.* [*Switzerland*], *16* (*1919*), *pp. 40*).—These are the proceedings of the annual meeting of the rural engineers of Switzerland for 1919, dealing mainly with matters relating to land drainage and soil improvement. A special section summarizes land drainage practice in the United States, quoting several bulletins of the U. S. Department of Agriculture on the subject.

Surface water supply of the North Atlantic slope drainage basins, 1917 (*U. S. Geol. Survey, Water-Supply Paper 451* (*1920*), *pp. 163+XXXVII, pls. 2*).—This report, prepared in cooperation with the States of Maine, Vermont, Massachusetts, and New York, presents the results of measurements of flow made on streams in 17 river basins in the North Atlantic slope during the year ended September 30, 1917.

Surface water supply of Ohio River Basin, 1917 (*U. S. Geol. Survey, Water-Supply Paper 453* (*1920*), *pp. 173+XXXII, pls. 2*).—This report, prepared in cooperation with the States of Illinois and Kentucky, presents the results of measurements of flow made on 23 river basins included in the Ohio River drainage basin during the year ended September 30, 1917.

The Columbia Basin Irrigation Project (*Olympia, Wash.: Wash. Columbia Basin Survey Comn., 1920, pp. 185, pls. 38, figs. 31*).—This report deals with the details of a project to irrigate 1,753,000 acres of land in southeastern Washington, using a gravity water supply from the Pend Oreille River (Clark Fork). The average requirement of the project for water is equivalent to 33 in. of rain. The cost of the completed project is estimated at $171.40 per acre. The soil of the project consists of silt loam, both rough and smooth, and light sandy soil.

Engineering features of the project are concrete dams and lined supply canals with relatively steep grades and high velocities.

Experiments on irrigation in the Bruchhausen, Syke, and Thedinghausen Association District, Province of Hanover [Germany], 1901–1912, B. Tacke (*Arb. Deut. Landw. Gesell., No. 291* (*1918*), *pp. 150, pls. 7, figs. 5*).—Experiments which extended from 1901 to 1912, inclusive, on combined irrigation and drainage supplemented by cultivation and fertilization are reported.

The soils on which the experiments were conducted were heather sand, clay sand, and moor soils. The different irrigation practices included mainly border flooding and furrow irrigation, and drainage was accomplished by border ditches. Irrigation in general was found to increase crop yields. Furrow and border flooding irrigation gave better results than so-called overstorage irrigation. Furrow irrigation gave better results than the border method owing to better utilization of the water and the more intensive cultivation. On moor and sand soils there was little difference in the results obtained from narrow and broad checks between the furrows, but on clay soils the broad checks were apparently the more desirable. Larger water quantities were better utilized on the furrow checks than smaller quantities. The reverse was true with border flooding.

The maximum results of irrigation were produced when it was supplemented by phosphoric acid and potash fertilization. Heavy additions of phosphoric acid gave better results than light applications, while with potash on sand soil the reverse was true. The results obtained from the use of potash on the moor and clay soils did not much more than pay for the potash applied. Potash, when used alone, gave no beneficial results, and sometimes caused injury to crops. The time of fertilization, whether before or after irrigation, apparently made no difference in the results.

Relatively weak drainage, resulting in a lowering of the ground-water level to about 30 cm. (about 12 in.) and permitting considerable storage of soil water, gave better results than drainage to 50 or 60 cm. This was true where the storage water was constantly renewed, otherwise better results were obtained by maintaining the soil water at a depth of from 45 to 50 cm. during the growing period.

Better general results were obtained on narrow than on broad plats in the moor soil, but little difference was observed in the depths to ground water. Cultivation apparently had no permanent effect on the yield of the irrigated plats, but planking on the clay soils was found to be a bad practice. Liming did not appear to be necessary on these soils.

The storage of drainage water in the drainage ditches caused a rapid rise of the ground-water level in all three soils. The fall of the ground-water level was about the same in all three soils as the drainage ditches were emptied. The degree of the influence of raising and lowering the water level in the drainage ditches on the ground-water level was found to depend also upon rainfall, evaporation, and humidity.

The sewage irrigation field of the city of Dülmen, A. Kreutz (*Landw. Jahrb., 52 (1919), No. 5, pp. 741–768, pls. 9, fig. 1*).—A detailed description of the planning and construction of the sewage irrigation plant for disposal of the sewage of the city of Dülmen, Germany, is given, together with a little data on operation.

The field apparently was originally swampy heather land, but was selected owing to its location and elevation with respect to the city. The raw sewage is applied by a distribution system direct to the soil by means of surface flooding and lateral percolation. The soil is mainly sand with a small amount of clay. A system of drainage ditches is necessary, and it was found that proper drainage permitted the successful growing of grasses usually grown on nonacid soils.

Comparative analyses of the raw sewage and drainage water during dry periods showed that the nitrogen and phosphoric acid content of the sewage was in a large measure absorbed by the soil. The potash content was not so well absorbed.

A system of multiple use of the sewage is employed, as it was found that a single use by lateral percolation, or a double use by surface flooding, did not remove all the suspended matter and dissolved organic matter. A triple use was found to be necessary to render the water unobjectionable. The operation is based on a sewage flow of 100 liters per capita per day and a minimum application of 5,000 and a maximum application of 10,000 liters per hectare per day. Thus the capacity varies from 50 to 100 persons per hectare per day as compared to that of the Berlin plant, which is 250 persons per hectare (100 persons per acre) per day. It is stated that so far the system has been satisfactory.

Land drainage from field to sea, C. H. J. Clayton (*London: Offs. of "Country Life," 1919, pp. XII+192, pls. 13*).—The main purpose of this book is to indicate the practical application of available drainage engineering knowledge to conditions in England.

It is shown that the condition of many of the main drainage channels in England is such as seriously to impair their efficiency. In this connection methods used in cleaning and straightening channels and in reducing the resistance to flow of drainage water in general are described. The removal of silt and weed growth seems to be one of the more important problems. In

addition, matters of drainage legislation in England are discussed, and the text of land-drainage acts, particularly those of 1918, are given and discussed. Hydraulic engineering data are also appended.

Missouri drainage and levee laws, D. BRYDON (*Missouri: Dept. Land Reclam., 1918, rev., pp. 165*).—The text of these laws is given.

Public Roads (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 29, pp. 24, figs. 10*).—This number of this periodical contains the following articles: Improving Improved Roads Now the Word in Maryland, by J. N. Mackall; State Highway Mileage and Expenditures in the Year 1919, by A. P. Anderson; Highway Administration and Road Conditions in Canada; Character of Federal-aid Roads Consistent with Traffic Demands; Highways in the High Schools, by C. J. Tilden; and Federal-aid Allowances—Project Statements Approved in August, 1920.

Widening and superelevating curves on Washington State highways (*Concrete Highway Mag., 4 (1920), No. 10–11, pp. 175–177, figs. 2*).—Graphic and other data are given for computing transition curves and superelevations for concrete roads.

Internal-combustion engine gasoline survey, N. A. C. SMITH (*Jour. Soc. Automotive Engin., 7 (1920), No. 3, pp. 300, 301, fig. 1*).—The results of a second semiannual survey by the U. S. Bureau of Mines of gasoline sold throughout the United States showed a greater decrease in the volatility of gasoline than could be accounted for as the normal change from winter to summer quality.

Studies of 82 samples collected from seven large cities showed that the distillation curve for July, 1920, practically paralleled the distillation curve for January, 1920, up to about the 75 per cent point. Above this point the curve rose rapidly. While part of this rise is attributed to the normal change between winter and summer quality, it is also taken to indicate adulteration with kerosene and careless refining to meet the demands for fuel.

Diagram to determine horsepower of gasoline engines, C. E. LOUNSBERY (*Engin. News-Rec., 85 (1920), No. 19, pp. 892, 893, fig. 1*).—Eight years' experience by the U. S. Reclamation Service in the selection of engines, principally for dragline excavators, showed that the Swedish formula for determining the horsepower of gasoline engines gives the best results. This formula is as follows: b. h. p. $=\frac{D^2SnN}{C}$ in which D=the bore diameter in inches, S=the stroke in inches, n=the number of cylinders, N=the number of revolutions per minute, and C=a constant. A value of C of 13,000 was used for 4-stroke cycle engines, and a diagram for 4-cylinder engines is given.

The conclusion was reached that by this formula an engine should show a rating 25 per cent in excess of the power actually required.

Farm and garden tractors: How to buy, run, repair, and take care of them, A. F. COLLINS (*New York: Frederick A. Stokes Co., 1920, pp. XVI+279, figs. 149*).—This is a popular treatise on the purchase, operation, repair, and care of tractors. General information regarding tractors is followed by a detailed discussion of tractor parts and mechanism. Considerable space is devoted to the description of tractors to meet different conditions, from garden work to large farm operation. The final chapters deal with drawbar and belt-power applications, care and repair of tractors, and tractor selection for specific uses.

Tractor analysis as applied to general farming—trailer type, C. OWENS (*Chattanooga, Tenn.: Author, 1920, pp. [1]+23*).—In this analysis implements are classified and analyzed according to similarity of construction, service according to season, implement functions according to tractor service, and tractor

construction according to implement functions. The so-called insurmountable features of tractor construction limiting tractor service and sales are also analyzed.

Report on implemental tillage at St. Augustine Experiment Station, 1919, J. de Verteuil (*Trinidad and Tobago Dept. Agr. Bul. 19 (1920), No. 1, pp. 19–29*).—Experiments on the cultivation of growing cane, breaking and leveling land, and preparing land for planting cane with mules and machinery as compared to hand labor are reported.

It was found that implemental tillage was cheaper than hand tillage, and fewer laborers were required to work an acre, especially when cultivating with mules. The kind of labor required was more easily obtained than that for hand tillage, and with sufficient stock and implements it was possible to work a larger acreage in a given time. When cultivating growing cane, the land was not so thoroughly tilled by machinery as by hand labor, but a better preparation for planting was obtained by the use of machinery.

The work is being continued.

Plowing in Java in connection with sugar cane culture, M. Flohil (*Cultura, 32 (1920), No. 384, pp. 275–294, figs. 11*).—A short review of mechanical cultivation methods employed in sugar cane culture in Java is given.

Use of machinery in the lifting of the potato crop, R. S. Seton and A. G. Ruston (*Univ. Leeds and Yorkshire Council Agr. Ed. [Pamphlet] 114 (1920), pp. 28, figs. 9*).—Comparative trials of four different types of potato digger are reported. These included (1) a rotary digger which breaks the potato ridge by a system of rotary arms revolving at right angles to the ridge and throwing the potatoes clear of the soil, (2) a scoop digger depending upon a shaker or riddler at the rear to shake the earth through a series of prongs and leave the potatoes clear upon the soil, (3) a machine which attempts to lift the ridge upon a moving elevator, the soil separating from the potatoes as they pass over the top of the elevator to the rear of the machine, and (4) a plain digger plow with a square-pointed share which lifts the potatoes and forces them on two sets of raisers, consisting of steel prongs so set as to resist and break the earth and lift the potato to the surface.

The machines showed average drafts of 560, 781, 952, and 448 lbs., respectively. The best all-round results were given by machine No. 1, the rotary digger. No. 2, while embodying some excellent mechanical methods, failed to produce satisfactory results. No. 3 damaged the potatoes and was of very heavy draft. No. 4, the digger plow, was eliminated owing to its crudeness and lack of mechanical development. It lifted the potatoes and then covered them again, making additional labor necessary. The rotary digger was more effective with two heavy draft horses than either Nos. 2 or 3 machines with four horses.

It is concluded that all the principles involved in these machines need further development.

Sewage disposal for the isolated dwelling and small institution, R. B. Wiley (*Purdue Univ. Engin. Expt. Sta. Bul. 6 (1920), pp. 36, figs. 15*).—This is a semitechnical bulletin giving information on the planning and construction of sewage disposal systems for isolated and rural residences and institutions.

The methods described consist essentially of preliminary treatment in a septic or Imhoff tank and final treatment by aeration in a stream, in soil, or on a contact, sprinkling, or sand filter. It is stated that the dry method of sewage disposal is very unsatisfactory and should be avoided wherever possible. Disposal by dilution is also considered inadvisable unless there is a continuous flow of at least 5,000 gal. of water per capita per day. Tank treatment and aeration are considered to be fundamentally complementary. A properly designed septic tank should remove about 50 per cent of the solids and about

50 per cent of the bacteria present in the fresh sewage. The Imhoff tank gives a better effluent than the septic tank, and the sludge is more easily disposed of. In general, if the number of people to be served is more than 20, the Imhoff tank should be used. The use of cesspools is condemned.

The importance of engineering advice in the design of sewage disposal systems where absolute purification is imperative is emphasized.

RURAL ECONOMICS AND SOCIOLOGY.

Directory of American agricultural organizations, 1920 (*Washington: U. S. Dept. Agr., Off. Farm Management and Farm Econ., 1920, pp. 75*).—Lists returned by the general secretaries of national farmer organizations and by State departments of agriculture were the authority in preparing this directory, which shows 265 national, 143 interstate farm organizations, and 1,761 agricultural organizations of State scope. In addition, classified lists of land-grant colleges, experiment stations, State agricultural officers, and farmers' organizations, a reference list of fairs and expeditions with dates for 1920, and one of organized national or regional highways are offered.

Agricultural geography, R. KRZYMOWSKI (*Landw. Jahrb., 50 (1917), No. 3, pp. 407–431; abs. in Zentbl. Gesam. Landw., 1 (1920), No. 1, pp. 2, 3*).—It is maintained that the study of agricultural geography, like that of agricultural history, has suffered a neglect unwarranted by its importance to agricultural science as a whole. It is said to supplement experience and experimental investigation with its comparison of agricultural phenomena in various representative sections of the world, and to have, therefore, a definite position in the system of agricultural science closely allied with physics, meteorology, chemistry, and botany, as well as with economics and statistics.

[Report of the] department of farm management, E. L. CURRIER (*Montana Sta. Rpt. 1919, p. 29*).—Two studies are noted in this report, one including 375 farms in the Billings region from which it was concluded that large stock yields, intensive stocking, and adequate size of farms are important factors in success. The other was made on 151 farms of less than 60 acres. It seems that on these high quality of farming skill, large crop yields, and high-class live stock are necessary to the realization of adequate returns. The sugar-beet crop was largely a determining factor. On the average, the sugar-beet farms produced a labor income of $976 and the nonbeet farms $364.

The cost of producing cotton, L. A. MOORHOUSE and M. R. COOPER (*U. S. Dept. Agr. Bul. 896 (1920), pp. 59, figs. 13*).—On the basis of estimates from 842 farms representing 10 districts in cotton-belt States, including Alabama, Georgia, South Carolina, and Texas, pertaining to the cotton crop of 1918, this study sets forth costs of man and horse labor utilized, material costs, including charges for quantities of seed used, amount of fertilizer applied per acre and quantities used of other materials necessary in growing and marketing crops, and other costs, namely, use of land or interest and rent charges, use of machinery, insurance and taxes, and overhead expenses.

Labor is indicated as the most important factor of cost. The percentage of the total cost ranges from 47 per cent in Ellis County, Tex., to 76 per cent in Tallapoosa County, Ala. In 8 of the 10 districts labor costs approximated 61 to 71 per cent of the total cost of production.

Ellis County farmers applied no fertilizer, but in the remaining areas the fertilizer expenses varied from 7 to 33 per cent of the total farm expenses. From 3 to 11 per cent of the total came under the head of ginning, bagging, and ties.

Farms are grouped according to the number of acres of cotton grown and with respect to yields obtained. It is indicated that as the yield of lint cotton increased the net cost per acre increased, while the net cost per pound decreased. The 24 farms having a yield of 100 lbs. of lint per acre and under show a net cost of $49.30 per acre and 57 cts. per pound, whereas 53 farms producing over 300 lbs. had a net cost of $80.65 per acre, and of 22 cts. a pound. In general, where comparison can be made, it appears that farms producing the larger acreages have the lower unit costs.

The normal time required for various operations, from cleaning ditches and terraces to marketing lint and seed, is tabulated in terms of crew requirements and man and mule hours per acre. The average total man labor requirement, hauling to market and supervision included, ranged from 63 hours per acre in Ellis County, Tex., to 154 hours in Barnwell County, S. C. In six districts following fairly uniform methods of cultivation the variation was between 131 and 145 hours for man labor.

Average total farm receipts by districts ranged from $1,041 in Tallapoosa County, Ala., to $7,079 in Ellis County, Tex., and the average total farm expenses from $594 in Marshall County, Ala., to $2,699 in Sumter County, Ga. The facts are derived that in 7 out of 10 districts combined receipts from lint and seed cotton constituted 85 per cent or more of the total farm receipts, and those from cotton seed approximated 12 to 14 per cent. Only in Dale County, Ala., were cotton receipts under 75 per cent of the total for all crops.

The average cost of producing was found to be 23 cts. per pound. The bulk of the cotton was produced at 28 cts. or less. Of that portion of the 1918 crop actually sold from the 842 farms prior to record taking, 76 per cent sold at prices ranging from 20 to 43 cts. per pound, and for 80 per cent of the crop thus sold the price varied from less than 25 to 32 cts. per pound.

Tables in the appendix show variation in cost of producing for each of the 10 districts.

The cost of producing winter wheat in Middlesex, Mercer, Somerset, and Hunterdon Counties, New Jersey, in 1917–18, H. Bloom (*New Jersey Stas. Rpt. 1919, pp. 300–318*).—Studies dealing with the determination of the cost of production of an acre of wheat in New Jersey are described. A survey of a limited area, embracing 44 farms in Middlesex, Mercer, Hunterdon, and Somerset Counties, was made in the winter of 1918 and included the crop of winter wheat seeded in 1917 and harvested the following summer. The data obtained are summarized and fully discussed from the standpoint of acreage, soil, production, crops grown, labor, land value, and fertilizer.

Records from the 44 farms showed an average income of $74 per farm for the wheat crop. The total area of the farms averaged 105 acres and the wheat area 12.5 acres. The average profit per bushel was 34.4 cts., about 20 per cent; the average yield, 17.2 bu. per acre; and the average profit per acre, $5.92. Farms on which potatoes were grown averaged 19.2 bu. of wheat per acre, and the other farms 16.4 bu.

Man and horse labor cost 29.9 and 25 cents per hour, respectively; 26.6 hours of man labor and 36.4 hours of horse labor were required for each acre of wheat.

The farms using less than 200 lbs. of fertilizer per acre, those having wheat acreage over 15 acres, and those having highest yields—above 19 bu. per acre, were most profitable, while farms with yields smaller than 15 bu. per acre lost money for their operators. The larger acreages of wheat were correlated with economy in the use of labor. Variation in land value appeared to have but little effect on profits.

Is the grain trade solicitous for the public? T. SANDERSON (*North Dakota Sta. Spec. Bul., 6 (1920), No. 1, pp. 12*).—This is an analysis of two editorials published in a journal of the grain trade,[1] May 5 and 12, 1920, in which the author indicates that the arguments presented there for the reestablishment of future trading in wheat are fallacious. Other articles in the same issue relate to the character and composition of screenings, including analyses of screenings, wild oats, and weed seeds, paying for dockage, the total dockage for the 1918 crop in North Dakota, and net value of screenings, prices of wheat compared with wheat products, and State elevators and their capacity.

Cooperation applied to marketing by Kansas farmers, T. MACKLIN (*Kansas Sta. Bul. 224 (1920), pp. 61, figs. 8*).—On the basis of 204 replies to questionnaires sent out to cooperative organizations, these replies representing 134 elevators, 34 stores, 13 live-stock shipping associations, 9 insurance companies, 7 buying organizations, and 7 engaged in other activities, this bulletin sets forth the characteristic features of cooperation as found in Kansas, emphasizing the important principles involved, and suggests undeveloped possibilities.

In 1916 there were no less than 553 cooperative organizations in the State, one at least dating back to about 1876. More than 62 per cent of those reporting, however, originated since 1910 and 95 per cent since 1900.

About one-sixth of the farmers in Kansas are members of functioning cooperative organizations. The value of their business in 1915 exceeded $41,000,000 and probably $100,000,000 in 1918. A successful two-thirds of the concerns reporting made savings of 6 per cent and upward, over and above all costs, including interest on capital. The other one-third were in no sense making financial savings for their patrons. Considerable variation was exhibited in the amount of authorized capital and of paid-in capital required by the main types of concerns, elevators, stores, and live-stock shipping associations. In 175 cases studied, 139 had authorized capital ranging from $5,000 to $15,000, while the paid-up capital in 144 instances ranged from $3,000 to $10,000. Two-thirds of 172 concerns reporting limited the size of shares at either $10 or $25, the $25 shares being most popular. Forty-seven out of 173 organizations reporting paid no interest on capital, the others paying returns ranging from 3 to 100 per cent, more frequently 8, 10 and 5 per cent.

It is brought out that managers were generally underpaid and that the principle of one vote to each member provided for in the State law had not been strictly adhered to. In addition to money savings, cooperation had stimulated improvement in the quality and quantity of farm products, promoted knowledge of marketing, and created individual and group interest in economic and social community problems. The main principles of successful cooperation are outlined.

The investigation brought out certain information which is used in pointing out the opportunity for further application of cooperative principles. Out of 702 Kansas towns in which elevators are located, 314 have two or more elevators, and probably not less than two-thirds of the grain handled by elevators in Kansas is marketed through towns each of which has two or more elevators. A consolidation through cooperation would at least double the business per elevator and effect a large yearly saving. It is likewise noted that duplication occurs in the marketing of butter fat, and consolidation on cooperative principles of cream stations and produce handling businesses, together with farmers' cooperative shipping of live stock at points from which about 100 cars are marketed yearly, is recommended. Cooperative general stores are

[1] Northwest Miller, 122 (1920), Nos. 5, p. 528; 6, p. 343.

advocated only under special favorable conditions of volume of business and efficient management.

Following extracts of Kansas law dealing with cooperative associations, a copy of a suggestive constitution of by-laws, is presented.

Detailed statistics of cooperation in Kansas and the location by counties of all the farmers' organizations included in the investigation are given.

Cooperative marketing of horticultural products, J. W. Lloyd (*Illinois Sta. Circ. 244* (*1920*), *pp. 3–15*).—This is a series of extracts from another publication previously noted (E. S. R., 42, p. 440).

Agriculture: The Organized Farmers, J. C. Hopkins (*Canad. Ann. Rev. Pub. Affairs, 19* (*1919*), *pp. 321–403, pls. 2*).—In this section of this report the position of Canadian agriculture, especially under war conditions and as influenced by the Government price-fixing policy, is set forth. The status of cooperative marketing and rural credits, the organization of Canadian farmers beginning in the West (E. S. R., 40, p. 688) and resulting in amalgamation, the formulation of a national farmers' platform which is reproduced in full, and the participation of Canadian farmers in politics are reported. Records of a number of the separate organizations for the year 1919 are given.

Agricultural wages in Dumfries and Galloway district, J. Wilson (*Scot. Jour. Agr., 3* (*1920*), *No. 3, pp. 329–334*).—The estimated general level of wages actually paid to farm workers of several classes in the winter half year, 1919–20, are given as derived from answers on schedules returned from 100 farms in this district.

The trend of agricultural prices, T. F. Hunt (*Commonwealth Club Calif. Tran., 14* (*1919*), *No. 12, pp. 452–458*).—Bradstreet's index numbers of the wholesale price of farm products in 1917 and 1918 are briefly noted to the effect that the wholesale price of staple farm products was not generally high during 1918. It is said that efficient production, equitable division, and wise consumption are necessary to prosperity. A number of questions are raised with regard to consumption of food and the relative prices of manufactured goods and of food and other raw materials.

The internal grain trade of the United States, 1850–1860, L. B. Schmidt (*Iowa Jour. Hist. and Politics, 18* (*1920*), *No. 1, pp. 94–124*).—A statistical study is made of the production and movement of grain, chiefly wheat, oats, corn, and barley in the decade 1850–1860, in which changes and tendencies were inaugurated that remained to the close of the century.

The internal grain trade of the United States is said to rest upon a territorial division of labor between the South, East, and West. The eastern and the southern were the two principal routes by which the grain traveled from one section to another and to the ports from which the surplus was exported. It is said that by 1860 the trade had become centered in five great primary markets, St. Louis, Chicago, Milwaukee, Toledo, and Cincinnati, and that New York City had become the foremost grain market in the whole country. At this time began the revolution which ended in the supremacy of the railroads over the water routes in the western grain and flour traffic. The eastern route triumphed over the southern in the competition for the handling of the traffic destined for eastern and European markets.

Some significant aspects of the agrarian revolution in the United States, L. B. Schmidt (*Iowa Jour. Hist. and Politics, 18* (*1920*), *No. 3, pp. 371–395*).—The agrarian revolution and the opening of the far West from 1860 to 1890 is reviewed in this paper. Among the factors contributing to the change were the liberal land policy of the Federal Government, the growth of population and immigration, the introduction of farm machinery, the extension and de-

velopment of transportation facilities noted above, and the development of agencies for the promotion of scientific knowledge relating to agriculture. The interest of the Federal Government in the promotion of agriculture is noted, and a brief history of the U. S. Department of Agriculture and the growth of the land-grant colleges are traced.

A short outline of Danish agriculture through the last generation (*Copenhagen: Union Danish Agr., 1919, pp. 24*).—This booklet contains statistical information and notes on cooperative societies, agricultural educational work, and Danish agriculture and the British market, presented by the Union of Danish Agriculture to British journalists on their visit to Denmark in August, 1919.

The value of the land after the war, P. Caziot (*La Valeur d'Aprèsguerre de la Terre. Paris: J. B. Baillière & Sons, 1920, pp. 46*).—This has been noted from another source (E. S. R., 42, p. 688).

The food-supply crisis and State action to overcome it (1914–1919) (*La Crise Alimentaire en Suisse, et l'Action Exercée par l'État pour la Surmonter (1914–1919) Rome: Internatl. Inst. Agr., 1919, pp. 26*).—This report, summarized from official and other sources by A. Sandonà, covers provisions promulgated in Switzerland in two periods, the first between the declaration of war and the intensification of the submarine campaign, 1914–1916, and the other from the beginning of 1917 onward. The earlier provisions were intended to keep intact and, if possible, to increase production of the necessary food of the people and to insure judicious use of stored supplies. The later ones apply to the problem of intensifying agricultural production involving labor economy, scientific use of land, limitation of consumption, and improvement of crops and live stock. A brief compilation of statistics is given to show the dependence of Switzerland upon a foreign food supply.

The food-supply crisis and State action to overcome it (1914–1919) (*Internatl. Inst. Agr. [Rome], Internatl. Rev. Agr. Econ., 11 (1920), Nos. 1, pp. 207–221; 3, pp. 287–293*).—This report has been noted as a separate publication in the above.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 6 (1920), No. 11, pp. 121–132, figs. 2*).—There are given as usual monthly summaries of acreage and condition, and brief articles, forecasts, and tabulated data as to stocks, farm value, and market prices of important agricultural products, including live stock.

There is in this number a brief note summarizing a report of a survey by W. F. Callender, in Ohio, relating to abandoned farms and the labor movement, in which it is estimated that there are now about 410,000 men and boys actually working on farms, compared with 470,000 a year ago and approximately 500,000 three years ago. It is indicated, also, that 80 per cent of the total number of farms in the State which changed hands last year were purchased by actual farmers who were living on them, while only 20 per cent were purchased for speculation or for the purpose of renting to others.

A tabulation of estimated averages from 1910 to 1913, inclusive, of the pounds per capita yearly consumption of cotton piece goods in a number of countries is included.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 2 (1920), Nos. 21, pp. 321–336; 22, pp. 337–352; 23, pp. 353–368, fig. 1*).—Abstracts of information on domestic movement, imports and exports, prices, and relative market conditions of specified commodities and classes of agricultural products, as well as of foreign market information, are given in these numbers, principally for the period up to the week ended November 27, 1920. In general live stock, grain,

cotton, hay, and clover seed showed liberal receipts and declining prices. Butter and cheese markets remained relatively firm.

A brief article in No. 22 notes that France is preparing for and may be expected to buy large quantities of food. In No. 23 the significance of imports of butter into this country, and particularly the effect on the market of Danish butter in competition with our medium grades, is commented on. Also the effect of the increased use of vegetable oil substitutes for lard in decreasing hog prices is suggested.

Crop reports and general business conditions for 1920, compiled by **Continental and Commercial National Bank of Chicago** (*Chicago: Continental and Com. Natl. Bank, 1920, pp. 47, figs. 7*).—Notes on the crop season of 1919 and charts illustrating the aggregate output and value in dollars of wheat, cotton, corn, hay, and oats, according to statistics contained in the Yearbook of the U. S. Department of Agriculture for 1919, also comparing the increase in the price level 1913 to June, 1920, of all commodities and of farm products and showing the percentage of decrease in the purchasing power of the dollar, together with summaries of business and trade in the United States, are brought forward to support an attitude of confidence in business conditions.

Prices and supplies of corn, live stock, and other agricultural produce in England and Wales, and summaries of colonial and foreign agricultural statistics, R. J. THOMPSON (*Min. Agr. and Fisheries [London], Agr. Statis., 53 (1918), No. 3, pp. 57–90; 54 (1919), No. 3, pp. 71–118*).—These tables show the imports of the principal foodstuffs and agricultural requisites during the war period, the acreage and production of the principal cereals, and the number of live stock in the different countries of the world, as well as a summary of the prices of grain and other produce during the respective years, continuing data previously noted (E. S. R., 41, p. 388).

AGRICULTURAL EDUCATION.

Agricultural and mechanical colleges, including statistics for 1917–18, W. C. JOHN (*U. S. Bur. Ed. Bul. 8 (1920), pp. 80*).—This is the usual compilation, from official sources, of statistics of land-grant colleges with reference to faculties, students, courses of study, value of funds and equipment, revenues, additions to equipment, and disbursements of Federal funds for 1917–18. The bulletin also contains the texts of the Federal law of March 4, 1915, and the territorial acts of 1917 and 1919 pertaining to the establishment of an agricultural college in Alaska; and extracts from the proceedings of the thirty-second annual convention of the Association of American Agricultural Colleges and Experiment Stations (E. S. R., 40, p. 595).

A comparison of the statistical data for 1917–18 with those for 1916–17 indicates that the total enrollment of white students declined from 122,053 to 114,913 and that of colored students from 11,352 to 9,340, while the number of professors, instructors, and extension and experiment station workers in institutions for white and colored students increased from 10,344 to 11,976. The attendance of students on four-year agricultural courses decreased from 16,409 to 12,426, and on four-year home economics courses increased from 5,055 to 5,191.

The number of bachelor degrees granted in agricultural courses decreased from 2,803 to 1,704, while those granted in home economics courses increased from 787 to 853. The number of advanced degrees in agriculture decreased from 221 to 218, and those in home economics increased from 9 to 112.

The total value of property decreased from $193,408,218 to $184,428,798. The total income for instruction and administration increased from $37,841,260

to $38,564,655; for experiment stations from $4,414,419 to $4,779,539; and for the extension service from $4,513,718 to $5,689,768, showing a total increase in income of $2,500,522, including for the first time $235,442 for vocational teacher training under the Smith-Hughes Act. Of the total Morrill-Nelson funds of $2,509,430 available for 1917–18, $593,903 was devoted to instruction in agricultural subjects and $24,525 to the training of teachers in special subjects.

A summary of statistics for the five years 1913–14 to 1917–18, inclusive, is also given.

Agricultural education and research (*Scot. Bd. Agr. Rpt., 8 (1919), pp. XXVIII–XLI*).—This is the annual report for the year ended December 31, 1919, on agricultural education and research work, including the training in agriculture of ex-service men and of disabled soldiers under the control of the Board of Agriculture for Scotland. It is shown that the attendance on the day courses at the three agricultural colleges increased from 117 in 1917–18 to 246 in 1918–19, and the evening course attendance from 345 to 633. The attendance at the two veterinary colleges increased from 26 and 7, respectively, in 1917–18 to 77 and 33 in 1918–19.

Agricultural education in some European countries, L. SILVEIRA (*Ensino Agricola em Alguns Paizes da Europa. São Paulo [Brazil]: Sec. Agr., Com., e Obras Pub. Estado São Paulo, 1920, pp. VIII+122, figs. 45*).—This report, presented to the Secretary of Agriculture, Commerce, and Public Works of the State of São Paulo, Brazil, contains résumés of the organization of agricultural instruction of all grades, including extension work in Belgium, France, and Italy, together with the author's conclusions and a brief bibliography of literature on foreign agricultural education. The report is based on a study of agricultural schools visited by the author in these countries.

The reorganization of agricultural schools, R. SCHULZ (*Deut. Landw. Presse, 47 (1920), No. 49, pp. 354, 355*).—Suggestions are offered for the reorganization of the agricultural schools (Landwirtschaftsschulen) in Prussia, including a plan which would increase the time devoted to special agricultural subjects without detracting from the dual purpose of the schools, namely, general culture and special training in agriculture; the admission of farmers' sons only; the requirement of a minimum age for admission of 13 or preferably 14 years; increased instruction in rural economics; and the addition of practical work to the present purely theoretical instruction. In addition to an internal reorganization of the older and approved agricultural schools, the author would extend their field of work by the addition of an agricultural winter school or a theoretical farm school and a seminar for farmers.

Agricultural training of disabled ex-service men, W. J. QUICK (*Fed. Bd. Vocat. Ed., Vocat. Summary, 3 (1920), No. 2, pp. 20–22, figs. 3*).—In this article, by the agricultural training officer of the Federal Board for Vocational Education, it is stated that up to May 15, 1920, over 4,000 men have been directly placed in agricultural training. Nearly all of them are yet in training, and, in addition, there are probably 500 engaged in prevocational work preparatory to taking up agricultural training. Probably from 1,200 to 1,500 men have been approved for agricultural training, but have not yet availed themselves of the opportunity.

The men approved for agricultural training are classed as (1) men who went into the war from college or high school, and returning have entered the agricultural colleges; (2) men with an eighth-grade preparation who are admitted into subcollege two-year courses in Smith-Hughes or other schools of agriculture; and (3) men of elementary grade, ranging from illiterate to the seventh or eighth grade, who of necessity must have prevocational instruction, and who constitute from 25 to as high as 55 per cent of the men approved for

agricultural training. The difficulties encountered in the training of the group of men of elementary grade constitute a real problem to both the Federal Board and institutions to which they are sent. To meet these difficulties the author has worked out an elementary school, termed a guidance school, where these men should be collected for the purpose of studying, trying out, and instructing them vocationally in the elementary common branches and in elementary agriculture. This is really prerequisite to certain agricultural unit courses prepared by the author, which are divided into units of one month each and cover one year continuously from month to month and may be entered any month. The plan of these courses is briefly explained. This system was first placed in operation in the Massachusetts Agricultural College and proved to be very satisfactory.

Organization and administration of part-time schools (*Univ. State N. Y. Bul. 697 (1919), pp. 42*).—This bulletin defines the provisions of the New York State law relating to compulsory part-time or continuation schools, and explains the rules and regulations of the regents of the University of the State of New York and the recommendations of the commissioner of education relative to the organization and administering of such schools. A suggested part-time home-making course and the text of the State act, effective August 1, 1919, and providing for part-time or continuation schools, practical arts or home-making schools, directors and schools of agriculture, mechanic arts, and home-making and teacher-training courses in schools of agriculture, etc., is included.

Part-time and evening classes in agriculture, C. H. LANE (*Fed. Bd. Vocat. Ed., Vocat. Summary, 3 (1920), No. 2, pp. 26, 27*).—This is a consideration of the object, location, equipment, and course of study for agricultural extension part-time schools or classes, followed by a summary of the part-time and evening class work in agriculture carried on in Arkansas, California, Georgia, Massachusetts, Montana, New Jersey, and Pennsylvania during the past year.

[Helps in nature study and elementary agriculture for rural teachers in the State of New York] (*Cornell Rural School Leaflet, 14 (1920), No. 1, pp. 120, figs. 63*).—This leaflet contains among others the following articles: The Use of Pictures in Presenting Ideas, Relation of Nature Study to Junior Project Work, Nature Study and Geography, Geography Exercises Based on Animal Distribution, Fifty Interesting Things to Look For in September and October, Making Fairs Fair, and A Lesson From the Rural School Exhibit at the 1920 Farmers' Week, by E. L. Palmer; Scouting on the Farm, by A. Perry; The Construction of Observation Hives, by W. P. Alexander; Potato Wart, A Dangerous New Disease, by L. M. Massey; and The European Corn Borer, by M. D. Leonard.

Report of the committee on teaching for the year 1919, W. F. HANDSCHIN (*Jour. Farm Econ., 2 (1920), No. 3, pp. 172, 173*).—The following general conclusions are drawn from the facts set forth in a tabular summary of 43 replies received to a questionnaire, sent by the committee on teaching of the American Farm Economic Association to the land-grant colleges in 48 States, regarding courses in agricultural economics, farm management, and allied subjects listed under 15 titles in common use and offered primarily for undergraduate credit:

There seems to be a considerable degree of uniformity as to the titles of the courses offered, and a high degree of uniformity as to the number of credit hours for the various courses, especially with reference to a few of the more general fundamental courses. A majority of the institutions reporting are already offering from 6 to 10 different courses in agricultural economics, farm management, and allied subjects, and give on the average approximately three credit hours for each. The committee recommends a more detailed study of

the general outline and content of such courses, including information regarding the regular texts, reference books, and collateral material, which is being found most helpful. Such a study, in its opinion, would establish a more satisfactory basis for transferring credits from one institution to another and would also contribute to a higher uniformity and effectiveness in teaching these subjects.

A comparative study of home economics courses in colleges, J. Krueger (*Jour. Home Econ.*, *12* (*1920*), *No. 6, pp. 249–252, figs. 4*).—Four charts compiled from data secured from correspondence and catalogues are presented and explained. The comparison is limited to a few colleges representative of the different sections of the country.

The data indicate such a wide variance of requirements existing among the different colleges and majors (general, food, textiles, and vocational education) that it is stated that very little emphasis may be placed on the averages shown. "The State agricultural schools, for instance, appear to require more nontechnical work in the food and textile majors than do the universities and endowed schools studied. They also require a larger percentage of general subject matter in the general major than the average for that division. This emphasis is accomplished at the expense of electives, and, in the case of the general major, science is curtailed. In the vocational education major more science than the average is required, slightly less general work, and fewer electives.

"In the universities, as a rule, a larger proportion of time is allowed for electives. These institutions require more science in the food major than the average indicated and in all majors less time in home economics subjects. The reverse of this condition is true in the endowed schools, where the percentage of time given home economics is high and that given electives and general subject matter is low."

The outstanding feature of the day is that each school seems to be a law unto itself. It is noted that "in the food major—perhaps the most carefully organized major of all—the averages for each division approach 25 per cent of the whole. That is, one-fourth of the credits required for graduation must represent languages, English, economics; one-fourth, science; one-fourth, home economics; and one-fourth, electives."

Texas high schools: Home economics, A. E. Harris and L. Peek (*Tex. Dept. Ed. Bul. 114* (*1920*), *pp. 123*).—This syllabus, prepared by a committee appointed by the State superintendent of public instruction in cooperation with the two State directors of home economics, is intended for affiliated nonvocational home economics classes and vocational home economics classes. Courses are outlined in clothing; design; design applied to costume and interior decoration; elementary foods and cookery; foods and elementary dietetics; biology; physiology, hygiene, and sanitation; home hygiene and home nursing; and the home and its management. Each course is preceded by a list of references to literature on the subject.

In the courses for which domestic art or domestic science credit is granted, five 90-minute periods a week throughout the year are required for one unit of affiliation. In all schools which receive Federal and State aid, all students in subsidized classes must take two units of home economics and related work annually. Home project work is required in each course.

Efficient arrangement in cooking laboratories, C. A. Morton (*Jour. Home Econ.*, *12* (*1920*), *No. 5, pp. 201–205, figs. 3*).—The author discusses a plan for a cooking laboratory which will overcome the difficulties of waste of space, much walking on the part of the teacher, the recrossing of students' paths,

etc., encountered in laboratories with the hollow square arrangement now in use in the majority of school cooking laboratories.

The rural hot lunch and the nutrition of the rural child, M. G. McCormick (*Univ. State N. Y. Bul. 696 (1919), pp. 19, fig. 1*).—Suggestions are offered for the organization of the hot noon lunch in the rural school, equipment, the lunch box, the food, the day's meals, and nutrition and weight. Recipes are included.

Commerce and industry, J. R. Smith (*New York: Henry Holt & Co., 1920, rev. ed., VIII+645, pls. 2, figs. 334*).—This book deals largely with the commerce and industries of the United States, and more briefly with those of foreign countries and world commerce. The industries described include the cereals; the animal, vegetable, fruit and canning, and forest industries; sugar and tobacco, fibers, textiles and clothing, etc. The physiographic influence in industry is treated in connection with the explanation of the industrial fact. A statistical appendix is included. The book is suggested as a reference in the study of economic and commercial geography, especially in vocational courses.

Farm machines, M. Ringelmann (*Ann. Inst. Natl. Agron., 2. ser., 14 (1919), pp. 97-127, figs. 6*).—A rather extensive analysis is given of the courses of instruction in farm machinery and of methods of study of farm machinery problems at the French National Institute of Agriculture.

Clothing—food—shelter, R. J Friant (*Missouri Vocat. Ed. Bul. 8 (1920), pp. 64*).—The author outlines a course of study in vocational home economics for the guidance of teachers in the selection of subject matter. The course is organized on a two-year basis with two units credit for each year. The work of each year deals with food, clothing, and shelter. Lists of references for the various subjects are included.

Suggestions for the teaching of textiles in elementary and high schools, F. E. Winchell et al., M. Willard, and C. Waite (*Jour. Home Econ., 12 (1920), No. 5, pp. 217-220*).—According to the author a suggestive course in textiles must be outlined in large elastic units, ready to be adjusted to the exigencies of the situation and varying in the order of presentation of subject matter and the method of attack, as determined by the type of pupil, by the needs of the group, by the economic situation, and by the organization of the curriculum. Work in the study of textiles is outlined for boys and girls in grades 1 to 6, inclusive, and for junior high school girls.

Study of fabrics, A. Turner (*New York and London: D. Appleton & Co., 1920, pp. X+206, figs. 32*).—This book contains a detailed study of the growth, manufacture, and physical and chemical properties of cotton, linen, wool, and silk, with special emphasis upon the practical household tests which may be used in detecting adulterations and in judging of the quality. Laundry problems and the hygiene and economics of clothing are discussed at some length.

MISCELLANEOUS.

Report of Alaska Stations, 1918 (*Alaska Stas. Rpt. 1918, pp. 104, pls. 10*).—This contains the organization list and a report of the several lines of work carried on during the fiscal year ended June 30, 1918. Meteorological data and accounts of the extensive tests with field and garden crops and other lines of work are abstracted elsewhere in this issue.

Forty-second and Forty-third Annual Reports of Connecticut State Station, 1918 and 1919 (*Connecticut State Sta. Rpts. 1918, pp. XIX+461-479; 1919, pp. XVI+506, pls. 56, figs. 28*).—These reports contain respectively the

organization list, a report of the board of control, and a financial statement for the fiscal years, ended June 30, 1918 and 1919. An index to Bulletins 207 to 214 is appended to the 1918 report, and reprints of Bulletins 215 to 222, previously noted, to that for 1919.

Report of Northwest Experiment Station, Crookston, 1919 (*Minnesota Sta., Rpt. Crookston Substa., 1919, pp. 32*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of West Central Experiment Station, Morris, 1919 (*Minnesota Sta., Rpt. Morris Substa., 1919, pp. 47, figs. 6*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Twenty-sixth Annual Report of Montana Station, 1919 (*Montana Sta. Rpt. 1919, pp. 48, fig. 1*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1919, and a report of the director on the work and publications of the station. The experimental work reported is for the most part abstracted elsewhere in this issue.

Fortieth Annual Report of New Jersey Stations, 1919 (*New Jersey Stas. Rpt. 1919, pp. XXXI+544, pls. 20, figs. 13*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1919, a report of the director prepared by F. G. Helyar on the work and publications of the year, and departmental reports, the experimental features of which, not previously reported, are for the most part abstracted elsewhere in this issue. An extensive report of the division of extension in agriculture and home economics, containing considerable data pertaining to demonstration work, is also included (pp. 177–287).

Report of the Virgin Islands Experiment Station, 1919 (*Virgin Islands Sta. Rpt. 1919, pp. 16, pls. 4*).—This includes the organization list, and a report by the agronomist in charge as to the work of the station from its transfer to the U. S. Government on January 1, 1919, to June 30, 1919. The experimental work reported is for the most part abstracted elsewhere in this issue. Rainfall data are appended.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta., 5 (1920), No. 10, pp. 257–271, figs. 2*).—This number contains, in addition to several articles abstracted elsewhere in this issue, the following: Fertility Experiments at the Ohio State University, by F. E. Bear, and Apples Adapted for Ohio Culture (Yellow Transparent), by W. J. Green, P. Thayer, and J. B. Keil.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 8, pp. 113–128, figs. 7*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles on the following subjects: Overcoming a Seasonal Difficulty, by M. E. McCollam; The Road to Winter Eggs, by Mr. and Mrs. G. R. Shoup; Artificial Illumination and Poultry Disease, by W. T. Johnson; Managing the Bull, by H. L. Blanchard; and Concerning Land Clearing, by W. A. Linklater, containing illustrations of an automatic choker and a gin pole.

NOTES.

Alabama College and Station.—Dr. Spright Dowell was inaugurated as president February 22. The inauguration exercises included, in addition to Dr. Dowell's address, papers by Dr. S. P. Capen, director of the American Council of Education, on New Problems in Education, and by Dr. E. E. Sparks, president emeritus of the Pennsylvania State College, on The College Student. Two important conferences were held, one for Alabama educators on the general topic of Better Cooperation among the Educational Forces of Alabama, and the other a land-grant college conference with Dr. A. C. True, director of the States Relations Service, as chairman. The latter conference dealt with the functions, business administration, and cooperative relations of the land-grant colleges and the practical value of technical training to the State.

Dr. True's address was entitled Liberal Education within the Land-grant College, and maintained that despite the notable success achieved by these institutions in the higher ranges of vocational education it is doubtful whether they have done their full duty in providing the liberal education equally required by the Morrill Act. A strong plea was made for greater attention to a wise selection of topics and material, approved methods of instruction, and particularly to the atmosphere surrounding the work. In the past, in his opinion, "too often the student has regarded all studies not strictly vocational as frills or impositions and therefore has received little impress from them even when they have been well taught. Whatever the institution can do through its general attitude and atmosphere to counteract this foolish notion and to inspire a desire for a liberal, as well as a practical, education will be well repaid in the broader and more satisfactory life of its graduates and its enlarged influence on the welfare of the country."

Connecticut College.—The legislature is being asked for $625,000, of which $400,000 is for a new science building for the chemical, botanical, physics, and bacteriological departments. The remainder is for maintenance during the ensuing biennium, and would be an increase from $150,000.

Georgia College.—David D. Long, in charge of the soil survey, has resigned to become soil specialist for the Soil Improvement Committee of the Southern Fertilizer Association.

Idaho University and Station.—The university budget as approved by the State Board of Education calls for appropriations of about $1,250,000, or nearly double those granted by the last legislature. Of this $74,000 is for the station and substations, and $250,000 for the extension division.

R. T. Parkhurst, for the past two years engaged in extension work in the Iowa College, has been appointed associate professor of poultry husbandry.

Illinois University and Station.—Daniel O. Barto, associate in animal husbandry, died January 18 at the age of 66 years. He was a graduate of the university in 1906 and had subsequently been in the service. In 1911 he was put in charge of the poultry department and was largely responsible for its subsequent development. He was also well known as an extension worker in

the State and the author of several text-books for use in grammar and secondary schools.

E. A. Bierbaum, instructor in pomology, resigned January 31. J. W. Randolph, instructor in agronomy, has been appointed assistant professor in agricultural engineering at the Alabama College. Additions to the staff February 1 included J. H. Baldwin as State leader in junior extension, Russell Laible as assistant in animal husbandry, Mabel Wilkerson as assistant State leader in home economics, and Mary C. Whitlock as instructor in clothing.

Purdue University and Station.—Under recent State legislation a 5-mill tax has been provided for the various State institutions of which 2 mills will be for Purdue University. With the present valuation of State taxables, this will represent an annual income to the institution of about $1,160,000. In addition a tax of 2/5 mill was levied for the support of the station. This will increase the State appropriations to the station from $75,000 to about $200,000 per annum. The increase does not become available until July, 1922, but an emergency appropriation of $100,000 has been granted to supplement the present appropriation until the funds from the new tax become available.

Kentucky University and Station.—W. H. Simmons, C. A. Mosgrove, and Mary E. Lesh, field agents, respectively, in veterinary science, junior club work, and clothing extension work, have resigned, the first named to become State veterinarian. Irene M. Piedalue and Helen Harriman have been appointed field agents in clothing extension.

Minnesota University and Station.—A. D. Wilson, director of agricultural extension and superintendent of farmers' institutes for the past 12 years, has resigned to take up farming in northern Minnesota, beginning June 30. Theodore E. Odland, assistant professor of agronomy, has accepted a position in charge of crop production work at the West Virginia University and Station, effective May 1. M. J. Thompson, superintendent of the Duluth Substation, has also been appointed associate professor of land clearing at the University Farm, beginning January 1. A. J. Schwantes has been appointed field assistant in land-clearing investigations beginning February 1.

Cornell University and Station.—Partly by purchase and partly through a gift of Mrs. Herman Bergholtz of Ithaca, the university has acquired and transferred to the college of agriculture and station a tract of 19.5 acres at the end of Cayuga Lake, which will be developed into a fresh water biological field station. The tract includes running water both from springs and from the lake, as well as swamp and high ground, and is considered almost an ideal place for the study of plants and animals in their natural environment. Plans for its development include the erection of an apiary and field laboratory building at an approximate cost of $15,000, and the construction of several ponds for the study of fish culture and propagation.

The fourteenth annual farmers' week ended February 19 with a registration of 4,116. This is the largest ever recorded, the highest previous figure being 3,763 in 1919.

D. B. Carrick, Ph. D., has been appointed professor of pomology, beginning February 1, for both teaching and experimental work. Dr. E. W. Lindstrom has been appointed assistant professor of genetics at the University of Wisconsin, where he will also continue his studies of variation in maize. H. W. Dye, assistant professor of plant pathology, is studying lettuce and celery diseases in a field laboratory at Sanford, Fla., under the direction of the Bureau of Plant Industry, U. S. Department of Agriculture. A. H. Nehrling has been appointed assistant professor of floriculture.

James E. Rice, head of the department of poultry husbandry, has been appointed chairman of the committee from the United States to attend the First World's Poultry Congress at The Hague, September 6–13.

New York State Station.—Dr. W. H. Jordan has tendered his resignation as director to take effect July 1, this date marking the completion of 25 years of service. Dean R. W. Thatcher, of the Minnesota University and Station, has been appointed to succeed him.

Recent appointments include Archie H. Robertson as assistant in research bacteriology and Leon R. Streeter and Henry L. Young as assistant chemists.

Ohio State University and Station.—The five State-supported educational institutions of Ohio are making a united campaign to secure appropriations aggregating over $9,000,000, of which nearly $6,000,000 is for buildings. The State university is requesting $4,469,360 for buildings and $2,251,325 for operation and maintenance. This contemplates the erection of thirteen new buildings in anticipation of a campus enrollment of 10,000 students in 1922–23. The buildings desired include a new agricultural building to cost $369,000, a horse barn to cost $47,000, and a dairy cattle barn and a beef cattle barn to cost $85,000 each. Appropriations of $25,000 have already been made for hog and sheep barns, and the construction of these buildings will be begun this spring.

Dr. Freda Detmers, assistant professor of botany in the university, has been appointed assistant botanist in the station. Other appointments in the university include Joseph L. Gayle as assistant in agricultural chemistry, Frances L. Morrison as instructor in rural economics, Dr. Clarence H. Kennedy as instructor in entomology, and Lewis H. Tiffany as instructor in botany.

Pennsylvania College and Station.—A farm adjoining the present experimental orchard has been purchased for development by the department of horticulture as a typical Pennsylvania fruit and vegetable farm. About 40 acres will be reserved for further experimental work with fruits. Commercial plantings of small fruits will be made this spring, including about 10 acres of grapes and an extension of present plantings of raspberries and strawberries. Attention will also be given to truck crops.

The farm will be available for student instruction in commercial operations and ultimately for summer practicum work for a limited number of students. The present buildings consist of a house for the farm foreman and a barn, but eventually it is hoped to add a combined fruit packing shed and storage house and other buildings.

A department of farm machinery has been authorized in the college. Estimates have been submitted to the legislature for a $200,000 farm machinery building.

Dr. John M. Thomas, president of Middlebury College since 1908, has been appointed president. Other appointments include William V. Dennis as associate professor of rural sociology, Charles E. Myers as associate professor of agricultural education, C. O. Cromer as associate professor of farm crops, William F. Hall as instructor in agricultural education, J. R. Haag as instructor in chemical agriculture, C. C. Vinson as extension specialist in pomology, R. W. Evans as assistant in horticulture and foreman of orchards, J. O. Sidelman as assistant in dairy extension, and Harry S. Sloat as assistant in farm management extension.

Porto Rico University.—C. E. Horne has been appointed dean of the college of agriculture and mechanic arts.

Tennessee University and Station.—W. C. Stiles has been appointed instructor in animal husbandry in the college of agriculture, and Hanvey Stanford assistant chemist in the station.

Texas Station.—*Science* notes that H. B. Parks, apiculturist, has resigned to accept a position with the State Honey Producers' Association and has been succeeded by Lloyd R. Watson, assistant in apiculture in the Bureau of Entomology, U. S. Department of Agriculture.

Utah College.—A special agricultural school for enlisted men for the U. S. Army has been organized, which is said to be the first of its kind in the country. The courses are given in Salt Lake City by members of the college faculty on Mondays and Tuesdays of each week, supplemented by special field excursions to various parts of the State under the management of the extension division and county agents. A 9-month program has been arranged, with courses in crops, dry farming, irrigation practice, farm live stock, dairying, beef and wool production, tractors and farm motors, truck gardening, farm management, marketing of farm products, and rural economics. All expenses of the school are paid by the War Department.

Death of a Staff Member of Experiment Station Record.—Edwin J. Glasson, specialist in horticulture and forestry for over fourteen years, died February 18 at his home in West Falls Church, Va., after a month's sickness.

Mr. Glasson was born in Troy, N. Y., September 6, 1878, and was graduated from Cornell University in 1903. After two years' experience in commercial floriculture and landscape gardening on Long Island and truck growing in Florida, he was appointed in 1905 an expert in the Bureau of Plant Industry, U. S. Department of Agriculture, and remained in this capacity for over a year, spent chiefly in field work with truck crops in Texas, prior to his appointment to the *Record* staff.

During his long period of service on the *Record*, Mr. Glasson prepared approximately 10,000 abstracts in horticulture and forestry. These abstracts were selected by him with much care and discrimination from the large volume of horticultural and forestry literature available, and their preparation reflected his thoroughness, conservative judgment, and wide knowledge along these lines. He had also been a regular contributor to *Experiment Station Work* until its discontinuance, to several yearbooks and encyclopedias and other works of reference, and was joint author of a Farmers' Institute Lecture published by the Department on Orchard Management. In his death the *Record* has lost one of the most experienced and capable members of its staff.

Lubin Memorial Exercises.—Memorial exercises in honor of David Lubin of California were held simultaneously in Rome, Italy, and Washington, D. C., March 1. The exercises in Rome took place at the International Institute of Agriculture, with whose establishment he was so intimately associated, a marble tablet being unveiled in his memory.

The Washington exercises were under the auspices of the Southern Commercial Congress. Addresses by Hon. J. W. Alexander, Secretary of Commerce, Senator James D. Phelan and Representative Julian Kahn of California, and Senator Duncan U. Fletcher of Florida dealt with Mr. Lubin's services for international commerce, the founding and development of the Institute, rural credits legislation, and other activities. A cable message to President Wilson from the King of Italy was read expressing his deep appreciation of Mr. Lubin's life and work, and an address by the Italian Ambassador, Baron Camillo Romano Avezzana, further emphasized the keen interest of the Italian Government.

The Institute itself was formerly represented by Madame Olivia Agresti, secretary to Mr. Lubin for many years and now lecturing in this country on behalf of the Institute. Madame Agresti described graphically the founding of the Institute and closed with a strong tribute to Mr. Lubin and the King of Italy, through whose patronage it became a reality. The exercises were

concluded by an address by Dr. C. J. Owens, presenting to the U. S. Department of Agriculture, on behalf of the Southern Commercial Congress, a replica of the painting of Mr. Lubin obtained by the Institute. This painting was accepted by Secretary E. T. Meredith for the Department in a brief speech expressing the interest of this country in the Institute and advocating its adequate maintenance and development.

School of Vocational Agriculture at Camp Devens.—Dr. Charles D. Woods, formerly director of the Maine Station, has been appointed director of agriculture at Camp Devens, Mass., beginning January 1. A school of vocational agriculture has been organized at the cantonment under his direction, and agricultural courses adapted to students with approximately grammar school education are being offered to enlisted men as a part of the Army vocational training. A large area of arable land is available, together with farm machinery, and it has been hoped to add considerable purebred live stock as needed.

It was originally planned to enlist each year a considerable number of young men from New England who did not have a high school education, teach them the essentials of military life, care of the body and mind, practical civics, and practical agriculture at this school. Some enlistments had been made along this line prior to the action of Congress reducing the size of the Army. This action has stopped enlistments for the present.

American Pomological Society.—Action taken at the convention of this society held at Columbus, Ohio, December 3, 1920, provides for enlarging this society into a clearinghouse and federation of all horticultural industries, including fruit exchanges, marketing organizations, fruit growers, machinery and packing manufacturers, fertilizer and insecticide companies, nurseries, etc. It is planned to have a Washington representative and an executive officer in Chicago.

The society will give much attention to matters relating to distribution and transportation problems, better grading and packing, horticultural legislation, and similar matters. Educational work will be undertaken to increase domestic consumption of fruit and fruit products and to develop export trade, notably in Europe, South America, and Australia. Close cooperation will be maintained with the American Farm Bureau Federation.

Officers of the society are as follows: President, Dr. L. H. Bailey; vice presidents, C. J. Tyson and W. T. Macoun; and executive committee, H. H. Hardie, G. H. Minnick, Paul Stark, Dr. C. A. Bingham, and Frederic Cranefield. R. B. Cruickshank of Ohio State University will act as secretary pending the employment of a permanent executive secretary.

American Food Research Institute.—Announcement has been made by the Carnegie Corporation of New York of an agreement with Leland Stanford University for the establishment on the university grounds of a food research institute. This institute is to undertake an intensive sudy of problems connected with the production, distribution, and consumption of food, utilizing the university laboratories so far as necessary. A grant of $700,000 has been made by the corporation for the institute for its support during the next ten years, and it is hoped to begin operations July 1. Cooperation with existing food research agencies is contemplated, and duplication of equipment is to be avoided so far as possible.

Press reports attribute the inception of the idea to Hon. Herbert Hoover, Secretary of Commerce, who will serve as a member of the advisory committee.

The active management of the institute is to be vested in a staff of three directors, representing agricultural, human nutrition, and economic phases of nutrition. Dr. C. L. Alsberg, Chief of the Bureau of Chemistry, U. S. Department of Agriculture, has accepted the directorship for agriculture, beginning about June 1.

Chicago Meeting of Geneticists Interested in Agriculture.—In conjunction with the meetings of the American Association for the Advancement of Science and affiliated societies in Chicago, an informal gathering of instructors and investigators of genetics related to agriculture was held December 28, 1920, at the University of Chicago. About 35 representatives from fifteen agricultural colleges and experiment stations, the U. S. Department of Agriculture, and other institutions were present.

The subject of departmental organization was taken up by J. A. Detlefsen of Illinois and R. A. Emerson of Cornell University. The diversity shown in many institutions as to the organization of instruction and research in genetics was pointed out. There was general agreement that a fundamental, general course of genetics should be required before taking up any applied courses in breeding, but the department in which that course should be given was deemed a secondary matter to be determined by existing conditions. The consensus of opinion was embodied in the following resolution:

"As far as consistent with present organization in agricultural colleges a single department of genetics, prepared to handle the elementary and advanced courses of general genetics and to direct the investigational work on the basic principles of genetics, has certain practical advantages, in that such an arrangement (1) simplifies administration and prevents unnecessary duplication; (2) identifies and gives standing to the subject of genetics in the curriculum; and (3) unifies instruction and research. Such a department should not attempt to control all the investigational work in specialized subjects on either the applied or theoretical problems of genetics, but would be able to cooperate in every way possible to advance the outcome of such investigations."

The place of genetics in the agricultural curriculum was discussed by E. B. Babcock of California and S. A. Beach of Iowa. A general course of genetics to be required of all students of agriculture was regarded as theoretically desirable, but in practice not always possible. Most institutions require genetics of students taking certain courses, particularly those concerned directly with plant and animal production. In other institutions genetics is optional with the student or left to the student advisers. Laboratory work is not always required except of those students who intend to specialize in genetics. It was held that there should be only one general course in genetics, to come as early in the curriculum as possible, usually in the second or third year, and to follow an elementary course in biology or its equivalent and precede any of the courses in applied genetics.

The subject of cooperation in genetic investigation was discussed by M. J. Dorsey of Minnesota, who emphasized the close relationship of genetic investigations on applied problems with other sciences, cooperation being particularly necessary to secure the greatest results. All who entered the discussion of this topic thought that cooperation should not go so far as to attempt to direct another's research, and that the success of any cooperation of this kind is limited by the mutual confidence of the workers. Resolutions were adopted expressing the interest of the group in the continuance of the cattle breeding experiment at the Maine Station.

At the close of the meeting it was agreed that no permanent organization should be formed, but that informal meetings such as this should be arranged for whenever desirable. L. J. Cole of Wisconsin, who served as chairman of the meeting, was designated to act as secretary ad interim.

EXPERIMENT STATION RECORD.

VOL. 44. APRIL, 1921. No. 5.

The annual act making appropriations for the support of the Federal Department of Agriculture is invariably a document of great importance to the Department and to all who are interested in its activities and welfare. The passage of this measure constitutes a virtual rechartering by Congress for another year. Its pages prescribe in considerable detail most of the Department's lines of work and limit quite definitely its allotments for the various purposes. It is the usual medium for the expression of Congressional policies regarding the Department and an indicator of current public sentiment as to the extension or curtailment of its various undertakings. It is also of quite general interest because it so frequently includes legislation on other agricultural matters.

The latest of these acts, covering the fiscal year ending June 30, 1922, was awaited with even more than the usual interest because of the new conditions under which it was considered. Among these may be mentioned the altered procedure for handling appropriation bills adopted by the House of Representatives, the impending change of administration resulting from the presidential election of last November, and the general business depression, accompanied by a strangly manifested demand for economy in Federal expenditures and reflected in a reduction by Congress of the various departmental estimates by nearly a billion dollars.

Regarding the first of these factors, it will be recalled that under a change in the House rules during the preceding session of Congress the privilege of reporting measures making appropriations was centralized in the Committee on Appropriations. The Committee on Agriculture, which had performed this function in agricultural matters since the establishment of the Department was thereby relieved of jurisdiction over appropriations, and the bill was framed by a subcommittee of the Committee on Appropriations. This subcommittee was made up of five members, headed by Hon. Sydney Anderson of Minnesota, who, together with Hon. Thomas L. Rubey of Missouri, had been transferred from the Committee on Agriculture. The change in procedure was confined to the House, however, and in the

Senate the bill was in charge of the Committee on Agriculture and Forestry as usual.

The policy of the House subcommittee was explained in its report accompanying the bill as in general "not to allow increased appropriations representing only increased investigational or extension work of the same kind as was being carried on under the appropriation. It was the belief of the committee that the present financial condition of the Government did not justify increased activities along lines which presented no particular or unusual emergency. The committee did allow increases where increased appropriations were necessary for the maintenance or preservation of the Government's property, for the full use of existing facilities or personnel, where infestations or outbreaks of animal or plant diseases presented emergencies which necessitated increased appropriations, and in cases where new or increased appropriations seemed desirable in aid of establishing new industries or finding new uses for existing agricultural products."

The bill as reported by Chairman Anderson carried $33,517,459. Further adjustments took place in the measure before enactment, and in its final form the total is $36,404,259. This sum is an apparent increase over the previous year of $4,691,475, but comparisons are complicated by several factors. Thus, the funds provided a year ago for the present fiscal year proved inadequate in several directions, and were supplemented in an act passed March 1, 1921, by deficiency appropriations aggregating $1,153,000. Also, the new appropriation act contains two items not directly related to the Department's work, one of $2,000,000 for loans to farmers in drought-stricken regions for the purchase of seed grain and the other a grant of $1,000,000 for the purchase of additional lands at the headwaters of navigable streams as a means of forest and water conservation. When allowance is made for these differences the expenditures authorized for next year for departmental purposes are seen to be about five hundred thousand dollars greater than those for the present year, but about five hundred thousand dollars smaller than those for the fiscal year ended June 30, 1920.

No alteration was made in the general salary scales of the Department, although in some cases an additional number of employees were authorized in the higher statutory grades. An innovation of much interest was the provision of two supervisory positions in the Office of the Secretary, each carrying a salary of $5,000 per annum and intended to be permanent in tenure. One of these was designated as director of scientific work, the occupant being expected to exercise immediate supervision of the research projects of the Department, for which the annual expenditures are estimated at about $12,000,000 per year. The other position, that of director of regulatory

work, will bear a corresponding relation to the Department's activities in the inspection of foods and drugs, meats, grain, cotton, nursery stock, and other commodities.

Another important administrative readjustment was the combining of the Bureau of Crop Estimates and the Bureau of Markets under the title of Bureau of Markets and Crop Estimates. Several advantages are expected to result from this plan, including economy through the consolidation of certain offices and staffs, particularly in the field service, and greater efficiency by facilitating the publishing of combined crop and market reports and in similar ways. Mr. L. M. Estabrook, former chief of the Bureau of Crop Estimates, has already been appointed associate chief of the Bureau of Markets under this reorganization, Mr. N. C. Murray serving as chief of the former bureau for the remainder of the fiscal year.

The tendency in recent years to enlarge the funds for combating plant and animal pests was continued. The allotment for the hog cholera campaign was increased from $410,000 to $510,000, and that for tuberculosis eradication from $1,480,440 to $1,978,800, the latter increase being mainly for the paying of indemnities. There were also smaller increases for many entomological and phytopathological projects, one of the largest items being a new project carrying $100,000 for the control of the Mexican bean beetle, a serious pest of beans, cowpeas and allied leguminous crops, which of late has been spreading with remarkable rapidity in the vicinity of Birmingham, Ala.

Taking up the allotments of the various bureaus and offices in detail, the funds of the Bureau of Animal Industry were enlarged from $5,477,156 to $6,070,576. This increase was due largely to the additional provisions for tuberculosis and hog cholera control just referred to. There was also allowed $50,000 more for the work of the Dairy Division, as well as allotments of $15,000 for improvements to quarantine stations, and of $8,000 and $3,000, respectively, for the erection of buildings at the Sheep Experiment Station in Clark County, Idaho, and the field station at Woodward, Okla. Likewise there was an increase of $5,000 in the Department's funds for experiments and demonstrations in live-stock production in the cane-sugar and cotton districts. On the other hand, reductions of $21,160 and $15,000 were made in the funds for cattle tick and dourine eradication, and the item providing $20,000 for experiments for horse breeding for military purposes was omitted.

The appropriations to the Bureau of Plant Industry showed an increase from $3,004,394 to $3,147,770, most of which is accounted for in the enlargement of the sum for the congressional seed distribution from $239,416 to $360,000. There was considerable readjustment

of the funds for the study of plant diseases, with increases of $9,980 to permit of work with brown rot and kindred diseases of peach trees, $4,600 for potato diseases to offset increased maintenance expenses at field stations in Maine and Colorado, and $20,000 to provide for studies of wheat scab. Decreases, however, were made of $30,000 for the citrus canker campaign, $114,168 in that for white pine blister rust eradication, and $20,000 in that for combating take-all, now found only in Madison County, Ill.

Opportunity is afforded through an increase of $10,000 for extending the bureau's studies of date culture, in which considerable popular interest is being manifested. Other increases included $10,940 for soil bacteriological investigations, $18,590 for acclimatization studies with cotton and other crops, $9,000 for tobacco work, $5,000 for investigations in economic and systematic botany, $10,000 for additional equipment and repairs at the various dry-land field stations, $42,040 to restore and extend the work in western irrigation agriculture following the curtailment last year, and $32,300 for the foreign seed and plant introduction. Another change was the restoration of the appropriation of $32,500 for biophysical investigations eliminated entirely in the previous act.

The largest appropriations to any one bureau were as usual allotted to the Forest Service, its total rising to $6,499,302. This was in addition to the appropriations of $1,000,000 for land purchases at the headwaters of navigable streams and $400,000 for cooperative fire protection of forested watersheds under the amended Appalachian Forest Reserve Act. The bulk of the appropriation is to be used in the administration, protection, and development of the national forests, which it is of interest to note returned in receipts for the fiscal year 1920 $4,793,482.28. An increase of $137,100 was granted for these forests.

Another notable increase of $101,740 was for investigations of forest products, thereby allowing additional studies of the utilization of waste materials, wood preservation and kiln drying, and similar inquiries. The funds for silvicultural investigations were increased from $50,000 to $85,000, partly to reestablish several forest experiment stations discontinued last year and partly for studies and advice to farmers as to farm forestry, while those for land classification and entry surveys were reduced by $12,000.

There was a reduction from $1,333,591 to $1,300,251 in the appropriations for the Bureau of Chemistry. This was occasioned largely through the elimination of an allotment of $52,880 for poultry, egg, and fish investigations, the work with poultry and eggs having been taken over by the Bureau of Markets and Crop Estimates as essen-

tially a transportation problem, and that with fish being discontinued because of its relationship with some of the work of the Bureau of Fisheries of the Department of Commerce. The appropriation for studies of insecticides and fungicides was also reduced $5,000, but this was offset by a corresponding increase for the development of methods to obtain sirup from sweet potatoes. A new item provided $25,000 to continue studies carried on during 1919–20 by the United States Grain Corporation of means of preventing explosions and fires through explosive dusts in grain mills, elevators, cotton gins, and like establishments.

Because of a change of policy involving the discontinuance of the Department's kelp plant at Summerland, Calif., a large reduction is shown in the appropriation for the Bureau of Soils, its total dropping from $542,215 to $393,615. Authority was given to sell this experimental plant, for which $192,900 was available in the previous act, and $5,000 was allotted for care and maintenance. The soil survey funds were also reduced by $10,700. On the other hand, there was an increase in the funds from $36,840 to $86,840 for the investigation of fertilizer resources, and the scope of the work was broadened to include the study of methods of obtaining fertilizing materials.

The total appropriations for entomological work were considerably increased, the Bureau of Entomology receiving $1,669,280 and the pink bollworm work directed by the Federal Horticultural Board $554,840 (an increase of $66,280), besides new and unassigned allotments of $100,000 to combat the Mexican bean weevil and $15,000 for the eradication of the Parlatoria date scale. The most striking of the bureau's increases is that from $250,000 to $400,000 for the gipsy and browntail-moth campaign, in consequence of the discovery of entirely new infestations of the gipsy moth in New Jersey, New York, and Pennsylvania; and its largest decrease was from $400,000 to $275,000 for combating the European corn borer. Opportunity was given to extend the investigation of powdered calcium arsenate as a means of control of the cotton-boll weevil through the establishment of several additional field stations, the appropriation being increased $40,000. Other pests, regarding which special provision was made, are grasshoppers, alfalfa and sweet potato weevils, the blowfly, and the screw worm. There was also a new appropriation of $15,000 to combat insect infestations on or near National Forests in cooperation with other agencies. This is a field of activity hitherto handled by the Forest Service from its forest protection funds, and the change is regarded as facilitating more systematic insect control.

The total appropriations under the States Relations Service show a decrease from $4,870,160 to $4,847,300, but this is due largely to the

elimination from the statutory roll of a number of low-salaried positions which had remained unfilled for some time. An increase of $10,000 was granted for general expenses and one of $5,700 for the work of the Office of Home Economics. The remaining appropriations were continued unchanged, including $1,440,000 under the Hatch and Adams acts, $210,000 for the insular experiment stations, $1,500,000 to supplement the permanent appropriation of $4,080,000 under the Smith-Lever Agricultural Extension Act, $634,800 for farmers' cooperative demonstration work in the cotton belt, $715,720 for the corresponding work outside that territory, and $16,360 for the work with farmers' institutes and agricultural schools.

An apparent decrease from $515,020 to $468,520 for the Bureau of Public Roads is explained largely by a transfer of expenditures for studies of road materials to the administrative fund provided for the bureau in the Federal Aid Road Act. There was an increase of $13,800 in the appropriation for economic studies of road management, and a decrease of $25,000 in that for road building and maintenance studies. The funds for irrigation and drainage investigations were increased by $9,560 and $20,000, respectively, thereby restoring the latter completely and the former partially to the amounts granted for the fiscal year 1920. A new item was the provision of $15,000 for the utilization of picric acid and other explosives in stump and rock removal. About 12,500,000 lbs. of picric acid are available from the war surplus, which it is hoped to salvage by putting it into cartridges and distributing to farmers and others at cost, largely through the county agents and similar agencies.

The consolidated Bureau of Markets and Crop Estimates received $3,004,444, an increase of $147,079. There was some rearrangement and reclassification of projects, including the establishment of a combined market news service with an allotment of $390,160, an increase of $33,300 for the food products inspection service, and one of $26,000 for the studies of methods of marketing and distributing farm products. For the crop estimating service $300,000 was provided, of which not less than $50,000 must be used for collecting and disseminating information relative to the world supply and demand for American agricultural products. This feature of the work is to be in cooperation with other branches of the Government, State agencies, organizations of farmers and consumers, and others.

An increase from $35,000 to $80,000 was granted for the enforcement of the U. S. Warehouse Act, and one from $147,350 to $156,510 for the Insecticide Act. The Warehouse Act is gradually being broadened in its application by the completion of regulations for additional commodities, cotton, grain, and wool now being covered, and with the expectation of extension to tobacco this fall. Virtually the same provisions as at present were continued for the enforce-

ment of the U. S. Cotton Futures Act, the U. S. Grain Standards Act, and the Standard Containers Act.

An increase from $375,390 to $414,830 was accorded the Office of Farm Management and Farm Economics. Authority was given to expend $150,000 of this sum for the cost-of-production studies, nearly doubling the funds at present available for this purpose.

The Division of Publications was granted $382,810, an increase of $8,720. This is exclusive of the appropriations for the Department's printing and binding, for which the previous appropriation of $725,000 was continued in the Sundry Civil Appropriation Act. Provision was made in the same act for continuing for five months the various journals and other periodicals of the Government, including *Experiment Station Record*, which under previous legislation would have been forced to cease publication on July 1. Specific authorization before December 1, 1921, is, however, required in each case for continuance beyond that date.

The work of the remaining bureaus of the Department was provided for substantially as at present. The Weather Bureau received an increase from $1,876,550 to $1,886,570. This includes $9,000 additional for the extension of the fruit frost-service forecasts as a guide to the employment by orchardists of artificial heating and other protective measures. The Bureau of Biological Survey was granted $823,325, a gain of $38,440, mainly to enlarge its campaign against rodents and predatory animals. The office of the Secretary received $467,560; the Federal Horticultural Board, $185,310; the Division of Accounts and Disbursements, $52,820; and the Library $51,460, a decrease of $3,020. The appropriation for miscellaneous expenses was increased $25,000, making $161,000 for this purpose, together with $164,666 for rent in the District of Columbia.

As usual a number of miscellaneous items were included in the act, but most of these were in continuation of previous undertakings or have already been referred to. The most important among them was the appropriation of $2,000,000 for the purchase of seed grain for drought-stricken areas. Under this legislation the Department may procure and sell to farmers wheat, oats, barley, and flaxseed for sowing, or make loans to them for the same purpose. In either case the total amount to an individual is restricted to $200, and a first lien on the crop may be required as security.

The President was requested to extend invitations to foreign Governments to send delegates to a world's dairy congress, to be held in this country in 1922. The joint committee of Congress for the study of rural credits appointed in 1920 was continued, with an appropriation of $5,000 to complete its work.

The final item in the act directs the Secretary of Agriculture to submit to Congress annually hereafter a report showing what investigations have been completed during the preceding fiscal year. A similar report is also required as to any services devolved upon it which are being performed or duplicated in whole or in part by other branches of the Government.

As the foregoing summary indicates, the new act may perhaps be briefly characterized as primarily a maintenance measure in a period of transition. The great bulk of the Department's activities have been provided for on the basis of previous years, but some further curtailments have been made, some increases have been allowed, and a few new lines of work have been authorized. The provision of permanent directors of scientific and regulatory work, the consolidation of the Bureaus of Markets and Crop Estimates, and the favorable attitude again shown by Congress to expenditures for the control of plant and animal pests may be cited as among the most striking features of the new legislation.

The act was signed by President Wilson March 3, just prior to the final adjournment of the Sixty-sixth Congress. This is much the earliest date of passage for any year since 1917, and affords an interval of nearly three months before the new appropriations become available. This margin will be an advantage to the Department, and will materially facilitate the planning of its operations for the new fiscal year.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Treatise on general and industrial inorganic chemistry, I, II, E. MOLINARI, trans. by J.-A. MONTPELLIER (*Chimie Générale et Industrielle Chimie Inorganique. Paris: Dunod, 1920, vols. 1, pp. XII+486, figs. 127; 2, pp. 272, figs. 75*).—This is a French translation in two volumes of the fourth revised and enlarged Italian edition, the English translation of which by Pope has been previously noted (E. S. R., 43, p. 609).

A textbook of organic chemistry, A. F. HOLLEMAN, edited by A. J. WALKER (*New York: John Wiley & Sons, Inc., 1920, 5. ed., rev., pp. XVIII+642, figs. 88*).—In the fifth edition of this well-known textbook the subject matter has been thoroughly revised and new matter incorporated. Considerable space has been allotted to the applications in organic chemistry of physico-chemical methods such as refraction, absorption, viscosity, etc., thus emphasizing the growing importance of these properties in organic chemical research.

A textbook of organic chemistry, E. V. MCCOLLUM (*New York: Macmillan Co., 1920, 2. ed., rev., pp. XLIII+466, figs. 29*).—The changes in the second edition of this book (E. S. R., 37, p. 108) consist principally in the addition of an introductory chapter on the purification and analysis of organic substances and the enlargement of the section on the organic chemistry of the proteins.

Industrial and manufacturing chemistry.—I, Organic, G. MARTIN ET AL. (*London: Crosby Lockwood & Son, 1920, 5. ed., rev. and enl., pp. XX+800, pls. 9, figs. 268*).—The principal changes which have been made in this edition over the previous one (E. S. R., 40, p. 408) consist in a revision of the section on hydrogenating or hardening of fats and enlargements of the sections on malt analysis and on waterproofing of cloths.

A brief manual of colloid chemistry, W. OSTWALD and P. WOLSKI (*Kleines Praktikum der Kolloidchemie. Dresden: Theodor Steinkopff, 1920, pp. XII+159, figs. 14*).—This laboratory manual of general methods in colloid chemistry consists of the following sections: Preparation of colloidal solutions; diffusion, dialysis, and ultrafiltration; surface tension and inner friction; optical properties; electrical properties; experiments with gelatins; adsorption; coagulation, peptonization, and related phenomena; and commercial colloids and other demonstration materials.

The carbohydrates and alcohol, S. RIDEAL (*London: Baillière, Tindall & Cox, 1920, pp. XV+219, figs. 11*).—This volume, which is one of the series of monographs on Industrial Chemistry edited by the author, contains a brief introduction on the physical and chemical properties of the carbohydrates, followed by sections on the industrial manufacture of starch and its products, including various starches, dextrin, glucose, and maltose; sugar, including cane sugar, beet sugar, sugar refining, minor sources of sugar, and caramel; beer, including sections on malting, mashing, boiling, hopping, and fermentation;

wine; distillation, including grain spirit, portable spirit, industrial alcohol, and synthetic alcohol; and vinegar, including vinegar, acetic acid, acetone, and glycerin.

Concerning inosite phosphoric acids, I, II, R. J. ANDERSON (*New York State Sta. Tech. Bul. 79 (1920), pp. 22; also in Jour. Biol. Chem., 43 (1920), No. 1, pp. 117–128; 44 (1920), No. 2, pp. 429–438*).—In continuation of the studies on phytin previously noted (E. S. R., 33, p. 11) two papers are presented.

I. *Synthesis of phytic acid.*—In this study the author has repeated the experiments of Posternak (E. S. R., 44, p. 309), but was unable to confirm his results.

"The only product which could be isolated in approximate purity from the reaction mixture corresponded to an inosite ester of pyrophosphoric acid containing 4 atoms of phosphorus or 2 molecules of pyrophosphoric acid. Traces of other inosite phosphoric acids are undoubtedly formed, but the above substance represents the principal product of the reaction.

"This new acid corresponds to the formula, $C_6H_{12}O_{16}P_4$. It resembles phytic acid in that it contains very nearly the same percentage of phosphorus, but its properties and reactions differ in several important particulars from those of phytic acid.

"The synthesis of phytic acid or inosite hexaphosphoric acid can not be considered as accomplished, and it appears doubtful if this substance can be successfully synthesized by the methods heretofore employed."

II. *Composition of inosite phosphoric acid of plants.*—In view of the disparity in the results of several investigators in regard to the composition of the phytic acid of wheat bran, this substance has been reinvestigated by analyzing the carefully prepared barium salts of the organic phosphorus compound isolated from it.

"The work fully confirms not only our earlier results with respect to the composition of the phytic acid of wheat bran, but the results are also in agreement with the preparations isolated from cottonseed meal, commercial phytin, oats, corn, and maple seed, which have been reported from this laboratory."

Occurrence of inosite hexaphosphoric acid in the seed of the silver maple (Acer saccharinum), R. J. ANDERSON (*Jour. Biol. Chem., 43 (1920), No. 2, pp. 469–475*).—Continuing the studies noted above, the author with the collaboration of W. L. Kulp, has identified the organic phosphorus compound previously isolated as a barium salt from the seeds of the silver maple (E. S. R., 39, p. 366). From an old sample of powdered maple seed the crystalline barium salt obtained corresponded to a barium salt of inosite pentaphosphoric acid, while the salt obtained from freshly powdered maple seed corresponded to tribarium inosite hexaphosphate. Evidence is presented that this difference is due to some spontaneous hydrolysis of the organic phosphorus compound in maple seed occurring during prolonged storage. Freshly powdered maple seed apparently does not contain any active phytase.

Large scale technical ultrafiltration, G. SCHMITT (*Chem. Ztg., 44 (1920), Nos. 107, pp. 657, 658; 109, pp. 669–671*).—This paper consists of a discussion of the principles of ultrafiltration and a description of apparatus for its application on a large scale.

Preliminary note on the use of some mixed buffer materials for regulating the H-ion concentrations of culture media and of standard buffer solutions, M. R. MEACHAM, J. H. HOPFIELD, and S. F. ACREE (*Jour. Bact., 5 (1920), No. 5, pp. 491–499, figs. 3*).—The advantages are pointed out of the use of a single solution of possibly two or three acids instead of several solutions as a buffer material for regulating the H-ion concentrations of culture media.

"We believe that one solution containing asparaginic acid and orthophosphoric (or pyrophosphoric) acid in equimolecular quantities suffices to cover

the entire range between 10^{-1} and 10^{-13} in practically a straight line or smooth curve relation between the H-ion concentrations and the number of molecules of alkali added to the mixture of the two acids. . . . The buffer or culture solutions can be made and kept sterile by making the original solutions decidedly alkaline at ordinary temperatures instead of in autoclaves, and afterwards adding a (sterile) strong acid in known amounts to secure solutions having higher H-ion concentrations."

Color standards for the colorimetric measurement of H-ion concentration pH 1.2 to pH 9.8, L. S. MEDALIA (*Jour. Bact., 5 (1920), No. 5, pp. 441–468, figs. 4*).—The author describes a series of color standards, prepared from the indicators developed by Clark and Lubs, for use in measuring slight differences in H-ion concentration. He also discusses their application to the titration of culture media, to the pH measurement of acid or alkali production by bacteria, and to the pH measurement of other fluids such as urine, blood serum, etc.

The preparation of the color standards consisted essentially in filling 7 tubes with approximately N/20 NaOH and 7 others with 0.1 per cent HCl. The 7 pairs of tubes are then set up in a rack, the tubes of alkaline solution behind the acid, and bromthymol blue or phenol red, 0.02 per cent aqueous solution, is added to the tubes containing NaOH in amounts of 0.1 cc., increasing by 0.1 up to 0.7 cc. from left to right, and to the tubes containing HCl beginning with 0.7 cc. and decreasing by 0.1 to 0.1 cc. from left to right. The 7 pairs of tubes with bromthymol blue yield a range of colors pH=6.4 to pH=7.6 at an interval of pH=0.2, while those of thymol red yield a range of from pH=7 to pH=8.2.

By the use of a simple comparator, titrations can be made to a desired H-ion concentration or the H-ion concentration of solutions can be determined.

Rapid volumetric methods for the estimation of amino acids, organic acids, and organic bases, F. W. FOREMAN (*Biochem. Jour., 14 (1920), No. 3–4, pp. 451–473, fig. 1; abs. in Chem. Abs., 14 (1920), No. 20, pp. 3044, 3045*).—The methods described were developed from the observation that ammonia, primary, secondary, and tertiary amins, and basic methylene derivatives of secondary amins do not form ionizable compounds with phenolphthalein in alcoholic solutions containing water if the concentration of the alcohol is sufficiently high, and that consequently in aqueous alcoholic solutions of the salts of these bases the acid radicals can be titrated accurately with N/10 alkali, using phenolphthalein as indicator, if more than 80 per cent alcohol is present. Extending these observations to amino acids, it was found that when aqueous alcoholic solutions of certain amino acids containing about 85 per cent alcohol were titrated with standard alcoholic potash the amino or imino groups liberated resembled ammonia and the amins in showing no basicity to phenolphthalein, and the carboxyl groups could thus be estimated accurately. Other amino acids, particularly aspartic and glutamic acids and prolin, gave results considerably below the calculated value, possibly due to loose combination of alcohol with one of the carboxyl groups or to loose condensation. On adding formaldehyde or an 80 to 85 per cent solution of acetone, or on using acetone in place of the original alcoholic solution, quantitative results were obtained with all the amino acids. Arginin reacted neutral in all these reagents, probably owing to the exact neutralization of the carboxyl group by the guanidin nucleus. The general method developed as the result of these observations is as follows:

A known weight of the amino acid or its salt or an amino acid mixture is dissolved in CO_2-free water and made up to a known volume of approximately N/10 strength. If the acid is difficultly soluble in water N/10 HCl or N/10 alkali is used to bring it into solution. The procedure consists of three steps: (1) Titration in water; a 5 or 10 cc. portion of the solution is titrated with

aqueous N/10 NaOH, with phenolphthalein as indicator; (2) titration in alcohol; a 5 or 10 cc. sample of the original solution is transferred to a 250 cc. flask, 10 volumes of 97 per cent alcohol and 3 drops of phenolphthalein are added, and the mixture is titrated with N/10 alcoholic potash until a light pink color is produced; (3) titration in alcoholic formaldehyde; the final solution obtained in part 2 is titrated with 12.5 cc. of aqueous formaldehyde solution (1:2) for each 50 cc. of alcohol used in part 2, and the titration continued to the same end point as before, the results being corrected by a blank titration. The carboxyl groups of all the amino acids contained in an amino mixture except that of arginin are estimated from the total titration value obtained in the third part, while the second gives quantitative results for phenylalanin, tyrosin, cystin, histidin, and asparagin, and practically quantitative results for tryptophan and lysin. The first titration gives useful information when dealing with dibasic amino acids, arginin, and the salts of amino acids.

Examples are given of wider applications of the method, particularly in the investigation of animal and vegetable materials containing the products of bacterial growth. The method is also of use in the rapid estimation of volatile bases, as the total titration value of an aliquot portion of the alcoholic extract affords an exact measure of the amount of alkali necessary for liberating the bases from their salts.

A new method for the estimation of methyl alcohol, S. B. SCHRYVER and C. C. WOOD (*Amer. Jour. Pharm., 92 (1920), No. 10, pp. 720–728*).—Previously noted from another source (E. S. R., 44, p. 11).

The effect of pressure upon the Polenske and Reichert-Meissl values, V. H. KIRKHAM (*Analyst, 45 (1920), No. 533, pp. 293–297*).—Observations that genuine butter fats analyzed in the Government Chemical Laboratories, Nairobi, British East Africa, invariably give very low Polenske values led to an investigation of the effect of variations of atmospheric pressure on Polenske and Reichert-Meissl determinations. Both of these values were found to vary with the pressure. The relationship in the case of the Polenske value was found to be represented by the formula $V=\frac{v\,(P-K)}{p-K}$ where P=pressure at which the Polenske value is V; p=pressure at which the Polenske value is v; and K=the constant or pressure at which the Polenske value is O, in this case 45.

The Reichert-Meissl value was found to be a logarithmic function of the pressure as represented by the formula $V=\frac{(v-K)\log P}{\log p}+K$. While the errors introduced in this value by ordinary variations in atmospheric pressure are small, the errors in the Polenske value are serious enough to necessitate a correction of the values to normal pressure.

The use of the refractometer in ascertaining the purity of certain refined oils, F. H. TRIM (*Jour. Soc. Chem. Indus., 39 (1920), No. 18, pp. 307T–310T, figs. 2*).—By determining the melting point and refractive index of dual mixtures of pure palm kernel, coconut, and arachis oils, and plotting melting point with percentage composition and refractive index with percentage composition, the author has obtained graphs from which he has compiled tables indicating the relative values of these constants for various combinations of any two of the three oils. If refractive indexes are taken as ordinates and melting points as abscissas, a closed graph is obtained which can be used for the estimation of the constituents of either dual or triple mixtures.

Report by the Committee of Analysts on standard methods of analysis of seeds, nuts and kernels, fats and oils, and fatty residues, O. HEHNER ET AL. (*Analyst, 45 (1920), No. 532, pp. 278–286, figs. 2*).—This report of the

committee appointed in November, 1918, by the Director of Oils and Fats (England) to consider the settlement of standard methods of analysis of oil seeds, fats, and oils, consists of detailed methods for the determination of oil in seeds, nuts, and kernels; for the various analytical constants of oils and fats; and for the evaluation of fatty residues such as soap stock, acid oils and fatty acids, cottonseed oil, black grease, and mucilage.

Report by the Committee of Analysts on standards of good merchantable quality, O. HEHNER ET AL. (*Analyst, 45 (1920), No. 532, pp. 286–289*).—This report, from the same committee as above, presents in tabular form schedules of standards for vegetable oils, seeds, nuts, and kernels of good merchantable quality. The standards for oil include percentages of free fatty acids calculated as oleic, moisture, and unsaponifiable matter, and certain other standards in individual cases. The standards for seeds, nuts, and kernels consist of the oil content and percentage of free fatty acids in the extracted oil.

The development of the polarimeter, N. DEERR (*Internatl. Sugar Jour., 22 (1920), No. 258, pp. 333–337*).—This is an historical sketch of the development of the polarimeter, with references to the original literature.

The double-polarization method for estimation of sucrose and the evaluation of the Clerget divisor, R. F. JACKSON and C. L. GILLIS (*U. S. Dept. Com., Bur. Standards Sci. Paper 375 (1920), pp. 125–194, figs. 2*).—This paper presents the results of an investigation of the conditions essential to the use of the Clerget method for sucrose determination, including the effect of different factors upon the inversion of the sucrose, the value of the rotation of invert sugar inverted by acid of the concentration prescribed by the prevailing methods, the modifications in procedure necessary when the sample to be analyzed contains impurities which may undergo a change in rotation in the presence of catalyzing acid, the influence of change in concentration of acid upon the rotation of invert sugar and the effect of neutralization of the acid after completion of inversion, and the precision with which known mixtures may be analyzed by the methods proposed as a result of these studies.

Four general methods of analytical procedure are suggested and described. One of these is of general application and requires no knowledge of the nature of the impurities in the substance to be analyzed. The other three are applicable, respectively, to pure sucrose or to sucrose mixtures in which the impurities are unaffected optically by hydrochloric acid, to beet products, and to cane products, the last method being applicable in the presence of invert sugar, but inapplicable in the presence of optically active nonsugars which change rotation with acidity.

In these methods 60° C. has been chosen as the most satisfactory temperature for the Clerget analysis. The value of the rotation multiplied by 2, of 13 gm. of sucrose in 100 cc., inverted and polarized in the presence of 6.34 cc. N HCl, was found to be −33.25 at 20° instead of the value −32.66 of Herzfeld. The basic value of the Clerget divisor was found to be 143.25 instead of 142.66.

[**Whole juice sugar (sucre complet)**], P. KESTNER (*Jour. Fabric. Sucr., 61 (1920), No. 5, p. 5*).—The author suggests the cultivation of sugar beets in various parts of France where they have not been grown hitherto to any extent, and the utilization of these beets in the manufacture of whole juice sugar (sucre complet). This sugar, a fine, mealy, hygroscopic product, sweeter than ordinary sugar, is made from the beet juice directly, the disagreeable flavor of the juice being removed by raising the temperature to a rather high degree for a short time. The product retains the nitrogenous and inorganic constituents of the original juice and is thus claimed to be of greater nutritive value than ordinary sugar, although containing only 90 per cent of sugar. It is par-

ticularly recommended for use in the chocolate and confectionery industries and is said to improve the taste of coffee. The requirements for the manufacture of this sugar are so simple that it is thought to offer possibilities in localities where the usual sugar factories can not be installed with profit.

Complete sugar, J. WEISBERG (*Jour. Fabric. Sucr., 61 (1920), No. 7, p. 5*).—A brief comment on the product noted above. The sweet taste is attributed to the inversion of some of the sugar owing to the natural acidity of the juice and the high temperature employed in evaporation.

A simplified process of sugar making, LINDET (*Compt. Rend. Acad. Agr. France, 6 (1920), No. 11, pp. 291–293*).—This is a brief description of the technique employed in the manufacture of the "sucre complet" noted above. The ordinary diffusion juice is heated with half the quantity of milk of lime usually employed and is then filtered and evaporated at 120 to 125° C. to the consistency of sirup, after which it is saturated with phosphoric acid and evaporated to a thick sirup at 130°. On cooling the sugar crystallizes as a fine meal.

The Kestner process, P. KESTNER (*Jour. Fabric. Sucr., 61 (1920), No. 12, p. 1*).—In this article the author emphasizes the point that the process described above is in no sense designed to compete with the present sugar industry, but should be of considerable interest in places where small factories could be installed to take care of the local sugar-beet production.

The chemistry of maple products, J. F. SNELL (*Canad. Chem. Jour., 4 (1920), No. 5, pp. 122–125, figs. 2*).—This is a compilation of data from various sources on the chemical composition of maple sap and sugars, together with descriptions of different methods for determining adulteration in maple sirup. Many references to the original literature are included.

Alcohol distillation from molasses, G. M. APPELL (*Sugar [New York], 22 (1920), No. 11, pp. 631–633, figs. 4*).—This is a brief discussion of the processes involved and equipment used in the manufacture of alcohol from black strap molasses.

The Association of Official Agricultural Chemists, H. C. LYTHGOE (*Chem. Age [New York], 28 (1920), No. 11, pp. 405, 406, fig. 1*).—This is a brief description of the origin and work of this association.

METEOROLOGY.

The mathematician, the farmer, and the weather, T. A. BLAIR (*Sci. Mo., 11 (1920), No. 4, pp. 353–361, figs. 2*).—This article discusses the application of mathematical and statistical methods to the study of the correlation between weather conditions during certain critical periods of plant growth with the ultimate yield of crops, as illustrated especially in the studies of Smith and others on corn, wheat, potatoes, and cotton; the adaptation of crops to climatic conditions; the application of frequency curves to climatic phenomena and crop growth and insurance; and long-range forecasts based on weather happenings in widely separated parts of the world.

The article as a whole shows how certain apparently unimportant and unrelated climatic data are, by the application of mathematical methods of study, being made to realize the dream of scientists, "which aims at predicting the general character of a season months in advance."

Factors of climatic control, E. HUNTINGTON (*U. S. Mo. Weather Rev., 48 (1920), No. 9, pp. 535–537*).—This is a critical review of an article previously noted (E. S. R., 42, p. 713). From a comparison of the results of studies by Humphreys, Köppen, Abbot, Fowle, and Arctowski, "it appears that at the present time far the greatest control of the earth's temperature is variations in

the sun. If a similar relation prevailed in the past, solar variations must have taken their part with terrestrial phenomena among the main causes of geological changes of climate."

The relation of prolonged tropical droughts to sun spots, W. H. Pickering (*U. S. Mo. Weather Rev., 48 (1920), No. 10, pp. 589–592, fig. 1*).—It is shown in this article, from a study of the collected rainfall data for Jamaica during the last 50 years, that "there have been 12 droughts, 9 of which have followed closely after a sun-spot maximum or minimum. It appears that droughts occurring after the maxima show a greater deficiency of rainfall, and last longer, than those occurring after the minima. On the basis of sun-spot data a drought, predicted in March, 1919, to begin during 1919 or 1920, actually began in June, 1919, and was continuing at the time of writing the paper. It is suggested that the cause of the variations of rainfall may lie in the effect of changes in ocean temperatures on condensation and evaporation in the Tropics, and the increased solar magnetic activity after sun-spot maxima, although the reason for such a solar relation is not apparent. The effects of volcanic dust on radiation may also be a factor."

An approximate seven-year period in terrestrial weather, with solar correlation, H. W. Clough (*U. S. Mo. Weather Rev., 48 (1920), No. 10, pp. 593–596, fig. 1*).—"The author presents data and curves for the United States showing the persistence of a period in weather averaging 7 years from 1790 to 1919. The length of this period varies systematically and periodically over an extreme range of 4 or 5 years in a cycle of about 25 to 30 years. These variations synchronize closely with similar variations in the length of the 11-year sun-spot period. The combination of the 7-year and the 11-year periods results in the subordinate crests found in the curve of the 11-year variation in temperature, and probably accounts for the period averaging 21 or 22 years noted by many investigators."

Economic results of deficient precipitation in California, A. H. Palmer (*U. S. Mo. Weather Rev., 48 (1920), No. 10, pp. 586–589*).—Results of markedly deficient precipitation in northern and central California during the past four rainy seasons, culminating in the dry season of 1920, are briefly discussed, including encroachment of the salt water of San Francisco Bay on the agricultural lands along the Sacramento, general shortage of water for irrigation, power purposes, and even for domestic use, and prevalence of destructive forest fires.

Some further uses of the climograph, B. M. Varney (*U. S. Mo. Weather Rev., 48 (1920), No. 9, pp. 495–497, figs. 5*).—The author concludes from the studies reported in this article that the climograph, as developed by Taylor and described in a report previously noted (E. S. R., 40, p. 716), "but in a modified form in which data for air temperature and relative humidity are used in place of those for wet-bulb temperature and relative humidity, is believed to be useful in many ways beyond the simple showing of monthly averages of climatic conditions as heretofore. In demonstration of this, four climographs (in addition to one using monthly averages) are given, three of them in a comparison of certain details regarding the climates of San Francisco and Fresno, Calif., the fourth to illustrate the climographic representation of a hot wave. Suggestions are made as to the usefulness of the climograph in depicting nonperiodic weather changes in general. The emphasis is on its value as a supplement to the conventional curve, as a help to the visualizing as far as possible of the effects of climate and weather on organic life."

Monthly Weather Review (*U. S. Mo. Weather Rev., 48 (1920), Nos. 9, pp. 495–564, pls. 16, figs. 11; 10, pp. 565–625, pls. 15, figs. 11*).—In addition to detailed summaries of meteorological, climatological, and seismological data and

weather conditions for September and October, 1920, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 9.—Some Further Uses of the Climograph (illus.), by B. M. Varney (see p. 415); The Katathermometer: An Instrument to Measure Bodily Comfort (illus.), by R. A. Jacob; Climate and Its Relation to Acute Respiratory Conditions, by E. Nichols; Irregular Atmospheric Refraction at High Altitudes (illus.), by E. R. Miller; The Relation of Telescopic Definition to Cold Waves (illus.), by W. H. Pickering; Weather and Literature, by R. E. Horton; Cloud Nomenclature, by C. F. Brooks; Layer Measurements of Snow on Ground Near Summit, Calif., by H. F. Alps and O. H. Hammonds; Life History of Tropical Storm in Louisiana, September 21 and 22, 1920 (illus.), by I. M. Cline; Tropical Storm, September 29–30, 1920, by A. J. Mitchell; Typhoon in Philippines, by J. Coronas; Climatological Factors Governing the Selection of Air Routes and Flying Fields, by C. L. Meisinger; Meteorological Aspects of the Recruiting Trip of the NC-4, by J. B. Anderson; and Factors of Climatic Control, by E. Huntington (see p. 414).

No. 10.—The Law of the Geoidal Slope and Fallacies in Dynamic Meteorology (illus.), by C. F. Marvin; The Great Cyclone of Mid-February, 1919 (illus.), by C. L. Meisinger; Economic Results of Deficient Precipitation in California, by A. H. Palmer (see p. 415); The Relation of Prolonged Tropical Droughts to Sun Spots (illus.), by W. H. Pickering (see p. 415); An Approximate Seven-year Period in Terrestrial Weather, with Solar Correlation (illus.), by H. W. Clough (see p. 415); and Effects of Heavy Rainfall on Panama-Canal Slides, by H. G. Cornthwaite.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and H. W. POOLE (*Massachusetts Sta. Met. Buls. 383–384 (1920), pp. 4 each*).—Summaries are given of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during November and December, 1920. The general character of the weather for November is briefly discussed, and the December bulletin gives a summary for the year. The principal data in this summary are as follows:

Mean pressure 30.004 in.; mean (hourly) temperature 46.4° F., maximum 92° August 8, minimum —18° February 1; total precipitation 50.09 in., snowfall 78 in.; cloudiness 1,795 hours; bright sunshine 2,662 hours; prevailing direction of wind, west, total movement 51,470 miles, maximum daily 537 miles March 6; last frost in spring April 26, first in fall October 7; last snow April 8, first November 12.

Weather conditions [on the Newlands Reclamation Project, 1919], F. B. HEADLEY (*U. S. Dept. Agr., Dept. Circ. 136 (1920), pp. 5–7*).—Observations at the Newlands Experiment Farm near Fallon, Nev., on temperature, length of the frostless period, precipitation, evaporation, wind velocity, and cloudiness are recorded for 1919 and compared with the averages for pervious years. It is stated that the frost-free period during the year was 15 days longer than normal, the last killing frost in spring occurring May 6 and the first in autumn September 22. "The season was exceptionally favorable for the growth of alfalfa, fruit, and those products of the field and garden which thrive best in hot weather."

The meteorological service of Canada, F. STUPART (*Roy. Soc. Canada, Proc. and Trans., 3. ser., 13 (1919), pp. LIII+LXXIX*).—A brief account is given of the work of this service for 1919, which included the usual meteorological observations and weather forecasts, as well as magnetic, seismological,

and phenological observations. Reference is made to a continuation of studies of the relation of yield of wheat and oats to temperature and rainfall by the method proposed by Connor, which has been previously noted from another source (E. S. R., 42, p. 617). The phenological observations reported include data from other Provinces of Canada as well as British Columbia.

Climate of British Columbia, compiled by F. N. DENISON (*Brit. Columbia Dept. Agr. Bul. 27 (1919), 5. ed., pp. 14*).—Tables are given which show the monthly and annual temperature, precipitation, and sunshine at various stations in this Province for the year 1919, as well as the average temperature and precipitation for those stations where observations have been recorded for ten or more years.

SOILS—FERTILIZERS.

Soil formation and soil classification, E. RAMANN (*Bodenbildung und Bodeneinteilung. Berlin: Julius Springer, 1918, pp. VIII+118*).—This treatise reviews the basic principles of soil formation, points out the narrow relation between soil and climate, and gives what is considered to be a natural classification of soils.

Soil forms are divided into those falling within climatic soil zones and regions; local soils, or those formed in climatic soil zones through special local influences, and soils owing their formation to special biological influences. The scope of the work is indicated by chapters on weathering, movement of soil water, soil organisms, soil distribution, climatic soil zones, and general soil classification.

Soil survey of Lincoln County, Mo., A. T. SWEET ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 44, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 388,480 acres in eastern Missouri. The area includes nearly level and gently rolling prairies, undulating, hilly, and broken areas, and level stream flood plains and terraces. It is said to be well drained.

The soils are of glacial, loessial, residual, and alluvial origin. They are divided into five broad groups, namely, (1) nearly level prairie soils with heavy clay subsoil, (2) brown hill soils not greatly eroded, (3) eroded hill soils, (4) light brown and reddish brown hill soils, and (5) bottom land soils. Including rough stony land, 20 soil types of 13 series are mapped, of which the Lindley, Putnam, and Genesee silt loams cover 24.2, 15.7, and 11.4 per cent of the area, respectively.

Investigations on the influence of forests on water resources, A. ENGLER (*Mitt. Schweiz. Centralanst. Forstl. Versuchsw., 12 (1919), pp. XV+626, pls. 52, figs. 5*).—An extensive report of studies of rainfall, run-off, and infiltration on forested and unforested areas in Switzerland is presented.

The studies were conducted by observing the run-off in ditch systems in the two types of areas. Variable conditions of precipitation, soil, and soil covering were considered, the first including heavy rain storms, heavy steady rains of relatively long duration, rapid snow melting, and dry periods. In general, it was found that the penetration of water into the soil and its escape through streams were greater in forested than in unforested regions. The forested soils were in general looser in texture to depths of from 40 to 50 cm. than the unforested and cultivated soils. The voids in the top layers of forest soils amounted to from 3 to 8 per cent, which was from 0.3 to 3 per cent greater than in unforested soils. There was considerable variation in the degree of looseness of both types of soil. The most porous forest soils were those in natural condition, while the most dense were those which had previously been meadow soils. Of

the unforested soils the meadows were the most dense, while those grown over with weeds and heather were the most porous.

Winter frost exercised a definitely favorable influence on the looseness of both meadow and forest soils. The porosity was usually greater in the spring than in the fall, and the density increased in mild rainy winters. The protected forest soils were much more pervious to water than the meadow soils, even on the steepest slopes. Heavy rainfall on meadows and pastures penetrated but little, and the plow sole in cultivated soils practically prevented the penetration of rainfall into the deeper layers.

The permeability of the soil was found to depend also on its stratification and moisture content, and on the air pressure, temperature, type of vegetation, and the so-called resistance to weathering. The resistance to weathering was less in forested than in unforested soils. Even though both soils indicated the same moisture capacity, the latter were able to retain more water. This is thought to explain the more frequent landslides in unforested soils.

The fine soils of pastures contained more water in the spring than forest soils, while in the fall the difference between the two soils was very small. It is concluded that unforested soils lose more water during the summer through vegetation than the forest soils.

An extensive study of the relations existing between precipitation and run-off on forested and unforested soils indicated that on the more steeply sloping soils the annual run-off from the former is approximately the same in amount as that from the latter. However, under similar conditions forest soils in mountainous and hilly regions contain more available water than unforested soils. It is concluded that the favorable influence of forests on the water economy of the soil depends primarily on the greater porosity and permeability of these soils, and that the influence of the forest itself rests merely in its indirect effect on the physical condition of the soils.

The rapid melting of snow in winter and spring produced a maximum water level in the soil and total run-off which was much less in the forested than in the unforested regions. Unfrozen forest soil absorbed and stored the greater part of the water from melting snow. Where the melting of snow took place in spring without rain, the run-off corresponded closely to the daily temperature. The forest soils showed great retentive powers for the water from heavy rainstorms, the run-off being only from one-third to one-half that of unforested soils.

It was found that for both forested and unforested soils the highest water level and the total run-off are in general dependent upon previous weather conditions. For steady rainstorms of relatively long duration the retentive powers of forest soils depended largely on the moisture content of the soil. The amount of run-off on both types of soil was governed largely by the intensity, duration, and amount of rainfall, and the absorptive power of the soil. In spring during thaw and in fall at the time of relatively low evaporation the run-off was greater on unforested than on forested soils. On the other hand, in summer and winter the run-off was greater from the forested soils. The daily variation of run-off was greater on unforested than on forested soils.

Determining soil acidity and alkalinity by indicators in the field, E. T. Wherry (*Jour. Wash. Acad. Sci., 10 (1920), No. 8, pp. 217–223*).—An indicator method and outfit are described which are said to be capable of giving definite information in the field as to soil reaction in many cases.

The outfit includes six indicators, which have proved most satisfactory in work with soils, and a table showing the classification of soil reactions and indicators by corresponding colors. In applying this method, a sample of soil a grain or two in weight is shaken from living roots into a vial and mixed

with water. After sedimentation the clear liquid is treated with one or more of the indicators until the specific alkalinity or acidity is determined from the table.

Correlation between vegetation and soil acidity in southern New Jersey, E. T. WHERRY (*Acad. Nat. Sci. Phila. Proc., 72 (1920), pt. 1, pp. 113–119*).—The indicator method above noted was employed in making observations on vegetation and soil acidity on areas indicated. Results are given in tabular form with discussion.

Soil tests of Ericaceæ and other reaction-sensitive families in northern Vermont and New Hampshire, E. T. WHERRY (*Rhodora, 22 (1920), No. 255, pp. 33–49*).—This paper reports the results obtained at different points included on a trip undertaken in June, 1919, under the auspices of the Bureau of Plant Industry, U. S. Department of Agriculture, for the purpose of making tests on members of the Ericaceæ in order to throw light on the question as to the relative importance of physical and chemical factors in determining the distribution of vegetation. The method was first tried out in the laboratory, and the results have already been noted (E. S. R., 40, p. 812).

While any given plant has an acid and an alkaline limit to its growth and may be regarded as indifferent to soil reaction if these limits are sufficiently wide apart, it has been found in the Ericaceæ and other families studied that these limits lie fairly close together, also that for different species the limits have characteristically different positions in the scale. When these points are considered in connection with the fact that in many cases a given species grows under widely varying physical conditions as regards moisture, the conclusion is regarded as safe that the chemical features of the soil are of greater significance than the physical in determining the distribution of these plants.

Observations on the soil acidity of Ericaceæ and associated plants in the Middle Atlantic States, E. T. WHERRY (*Acad. Nat. Sci. Phila. Proc., 72 (1920), pt. 1, pp. 84–111*).—Both before and since making the excursion above noted, observations were made at places in Pennsylvania and adjoining States, and in the present paper some of the results obtained are noted. The areas indicated as studied are included in what are termed the Alleghanian Zone (Appalachian Mountain and Piedmont) and the Carolinian Zone (Coastal Plain).

Observations are detailed as made on a number of individual species, and tabulations are given for the reactions exhibited.

Experiments in the reclamation of alkali soil, F. B. HEADLEY (*U. S. Dept. Agr., Dept. Circ. 136 (1920), pp. 16–21, figs. 3*).—A continuation of studies begun in 1917 at the Newlands Reclamation Project Experiment Farm near Fallon, Nev., on the effect of manure on the yields of wheat, fodder corn, and mangels in alkali soil, previously noted (E. S. R., 43, p. 420), showed that in the year 1919 wheat yields were increased thereby from 6.1 to 6.7 per cent and corn yields 1.8 per cent.

Experiments on the effect of gypsum and manure on alkali soils growing barley and alfalfa indicated that gypsum is decidedly beneficial to this type of soil, although the treatments so far have not been profitable.

Further experiments on soils containing so much alkali that germination is seriously retarded showed that manure was decidedly beneficial wherever used, and that when it was used in combination with sulphur, gypsum, or acid phosphate the yields were generally greater than when used alone.

Bacteriological studies of methods of preparing a seed bed for wheat, P. L. GAINEY (*Kansas Sta. Tech. Bul. 8 (1920), pp. 3–64, figs. 10*).—Studies to determine the reason for observed differences in the rate of nitrate accumulation in soil following various methods of seed-bed preparation are reported.

Under laboratory conditions it was found that no appreciable differences could be detected in the relative efficiencies of the various soil flora in ammonia formation or in bringing about nitrate accumulation. No indications of differences in the potential possibilities of the different flora as they exist under field conditions could be detected, nor were there any indications of subnormal activity on the part of the nitrifying organisms. Differences were noted in the rate at which organic matter decomposes in deep and shallow cultivated field soils, resulting in the formation of larger quantities of ammonia in the former and thus rendering greater nitrate formation possible. This difference is attributed to the environmental conditions of the flora rather than to any difference in the various flora.

The principal environmental factors responsible for variations in the decomposition of organic matter are thought to be the distribution of organic matter and available moisture. The major difference in the accumulation of nitrates observed to occur between early and late cultivation is explained by the utilization of nitrates by the growth of weeds on the late cultivated soils.

Soil investigations, A. E. GRANTHAM (*Delaware Sta. Bul. 125 (1919), pp. 5–8*).—Lime, fertilizer, and rotation experiments in soil fertility studies have shown the effect of phosphoric acid and potash in increasing crop yields. In a 4-year rotation of corn, soy beans, wheat, and red clover, potash was indicated to be one of the limiting elements in the Sassafras silt soil. Lime increased the yield of hay in the rotation 40 per cent in some cases and, with some exceptions, the yield of corn, but seemed to injure soy beans.

Studies on the relative values of various forms of lime and lime-bearing materials, including several carriers of phosphoric acid, have shown little difference in the effectiveness of the different forms of lime. Acid phosphate has proved to be a more effective carrier of phosphoric acid than any other, followed in order by basic slag, bone meal, and rock phosphate.

Tests of organic and pepto-humic fertilizers, J. AUROUSSEAU (*Tech. Engrais, 1 (1920), No. 1, pp. 9–11*).—Comparative tests of a so-called pepto-humic fertilizer, consisting of a combination of a peptonized fertilizer of animal origin and a humus fertilizer with a peat base, with complete mineral fertilizers and complete fertilizers with an organic base are reported.

It was found that on fertile soil this fertilizer gave better results than the other fertilizers with beets, carrots, potatoes, beans, oats, and prairie hay. It is said to contain 6 per cent of nitrogen, 6 per cent of phosphoric acid, and 4 per cent of potash. The superior activity of this fertilizer is attributed to the active components of its so-called black matter or colloid content.

Analysis of droppings of caterpillar (Antheræa cytherea), C. F. JURITZ (*Chem. News, 121 (1920), No. 1357, p. 181*).—Analyses of caterpillar droppings are reported and compared with analysis of horse, cow, and barnyard manures. It is noted that the caterpillar droppings contain a relatively high percentage of potash, and compare very favorably with the other manures in their contents of nitrogen, lime, and phosphoric acid. Owing to the abundance of the droppings during some seasons in South Africa it has been proposed to use them for fertilizing purposes.

Experiments on sewage purification, A. R. PADMANABHA IYER (*Cent. Provs. and Berar Dept. Agr. [India], Rpt. Agr. Col., Nagpur, Bot. and Chem. Research, [etc.], 1919, pp. 21, 22*).—Sewage irrigation experiments showed that dilute sewage can be applied to black cotton soil with greater advantage than concentrated sewage, owing to the fact that more nitrogen is made available as nitrates with the former. This result is not as yet considered to be conclusive.

Explosions from fish meal dust, D. J. PRICE (*Amer. Fert.*, *53* (*1920*), *No. 11*, *pp. 61–63*, *figs. 4*).—Experiments conducted by the Bureau of Chemistry of the U. S. Department of Agriculture are briefly reported, showing that the dust produced during the manufacture of fish meal is very inflammable and in proper mixtures explodes with much violence. Other fertilizer dusts were also found to be explosive. The results of these tests are taken to indicate the necessity of precautionary measures for the prevention of dust explosions in the fertilizer industry.

Comparative experiments with different nitrogenous fertilizers, CLAUSEN (*Deut. Landw. Presse*, *47* (*1920*), *Nos. 10*, *pp. 73*, *74*; *11*, *pp. 84*, *85*; *13*, *pp. 99*; *14*, *p. 107*).—Experiments with rye, oats, buckwheat, flax, potatoes, and peas on different soils, to determine the relative value of ammonium sulphate, ammonium chlorid, potassium-ammonium nitrate, sodium nitrate, and sodium-ammonium nitrate as nitrogenous fertilizers, are reported.

As a whole, no great differences were observed in the average results obtained with the different fertilizers. Ammonium sulphate gave in general the best results with the grains. The grain crops produced by sodium-ammonium nitrate and in part by the potassium-ammonium nitrate were increased where the soil was loamy. Sodium-ammonium nitrate gave the poorest results with potatoes and ammonium chlorid the best. It was found that ammonium chlorid, sodium-ammonium nitrate, and potassium-ammonium nitrate could not be used profitably on buckwheat.

The changes taking place in cyanamid when mixed with fertilizer materials, R. N. HARGER (*Jour. Indus. and Engin. Chem.*, *12* (*1920*), *No. 11*, *pp. 1111–1116*, *figs. 3*).—Experiments conducted by the Bureau of Plant Industry of the U. S. Department of Agriculture are reported, which showed that when cyanamid is mixed with fertilizer materials containing acid phosphate and from 5 to 10 per cent of moisture, the cyanamid content decreases with great rapidity. This change is represented partially, and in the higher concentrations principally, by the formation of dicyandiamid. A given quantity of moist acid phosphate was found to be able to transform a limited amount of calcium cyanamid. The cyanamid was not affected by dry phosphate, and it is concluded that moisture alone is able to cause the conversion of cyanamid to dicyandiamid, although the change is much slower than when acid phosphate is present. The studies are being continued.

A raw phosphate of Estland (Esthonia) and its action on different plants, M. WRANGELL (*Landw. Vers. Sta.*, *96* (*1920*), *No. 1–2*, *pp. 1–44*).—Experiments on the fertilizing value of so-called obolus sandstone, which contains obolus-shaped formations of raw phosphate, are reported. This raw phosphate contains about 35 per cent of phosphoric acid and about 52 per cent of lime.

Cropping experiments with different crops to compare this phosphate with other phosphoric-acid-bearing materials showed that plants vary considerably in their ability to assimilate the phosphoric acid of difficulty soluble phosphates. In this respect they are separated into two groups—those which can thrive on raw phosphates and those which require soluble phosphates for maximum yield.

It was further found that the assimilation of raw phosphate can be aided by the use of physiologically acid supplemental fertilizers. Individual raw phosphates varied considerably in their availability to plants. Crystalline fluorapatite was inactive, while apatite, staffelite, phosphorite, and the Esthonian obolus sandstone were generally well utilized by plants, particularly the last, which gave as good results as Thomas meal. It is concluded that the use of raw phosphates by properly choosing crops is of practical importance.

The origin of the German potash deposits, JÄNECKE (*Jahrb. Halleschen Verband. Erforsch. Mitteldeutsch. Bodenschätze, No. 1 (1919), pp. 56–66, figs. 11*).—The author deals with the origin of the German potash deposits from the chemical viewpoint, showing that the chemical theory corresponds completely with geological findings.

The potash of Alsace, J. CARLIOZ (*Génie Civil, 76 (1920), No. 25, pp. 548–552, fig. 1*).—This article deals with the history, geology, treatment, and sale of the potash salt deposits of Alsace from the French viewpoint.

New potash fertilization experiments and other related investigations, H. G. SODERBAUM (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 201 (1920), pp. 14; also in K. Landtbr. Akad. Handl. och Tidskr., 59 (1920), No. 3, pp. 148–158*).—Experiments with oats on moor soil deficient in mineral constituents are reported.

A maximum crop yield was not obtained by complete fertilization of this soil, and rather heavy liming was necessary before a normal crop production took place. The total crop reached its maximum with a much smaller lime addition than that required by the maximum grain crop.

The addition of lime in increasing amounts increased the ratio of straw to grain in the beginning, but later with the greater lime additions the opposite was true. Heavy liming produced variations in the results of fertilization, especially in the case of grain, in similarly treated plats.

Calcium chlorid added with potassium chlorid in the ratio of 3:1 injured plant growth and inhibited the fertilizing action of the potassium chlorid. This condition was corrected by a heavy addition of calcium carbonate. The acid and water-soluble potash of a so-called potash lime fertilizer gave as good results as are normally obtained with potassium chlorid and sulphate, and the calcium silicate, composing the greater part of this fertilizer, gave results similar to calcium carbonate on this soil. A mixture of calcium carbonate and silica also gave as good results as calcium carbonate.

The cause of the injurious action of potassium and sodium salts on the soil structure, G. HAGER (*Jour. Landw., 68 (1920), No. 2, pp. 73–105, fig. 1*).—In a further contribution to the subject (E. S. R., 41, p. 519), experiments are reported which showed that in all cases relatively small additions of sodium chlorid decreased the permeability of soils. The turbid condition of the drainage water was considered to be an indication that peptonization of the highly dispersed clay had taken place, due to the electrical charging of the soil particles.

Where sodium carbonate formation was prevented, the exchange of ions, with accompanying results, was considered to be the sole cause of the breaking up of the soil crumb structure. It is concluded that the crust formation in heavy soils heavily fertilized with raw potash salts is in general due to the exchange of ions, if only potash salts free from alkaline sulphates are used. When potash salts containing alkali sulphates are used, however, the sodium carbonate formation will not have the same effect on the soil structure as an exchange of ions. Excessive breaking up of the soil crumb structure can be prevented by using relatively small applications of potash salts.

Attention is also drawn to the practical fact that much of the soil crumb structure is destroyed by heavy rains and repeated plowing.

The need for lime on plowed-out grassland, J. A. HANLEY (*Univ. Leeds and Yorkshire Council Agr. Ed. [Pamphlet] 115 (1920), pp. 32, figs. 10*).—Experiments on the cropping of light loam soil which had been in grass for 20 years showed that the unreliability of these acid soils is due primarily to lack

of lime. Until well limed it was impossible to successfully grow sensitive crops, such as barley or wheat. It was possible, however, to grow oats, potatoes, and rye.

It was found necessary to incorporate the lime with the whole of the soil turned up, which was accomplished best by working the lime into the soil after plowing.

Gypsum deposits of the United States, R. W. STONE ET AL. (*U. S. Geol. Survey Bul. 697* (*1920*), *pp. 326, pls. 37, figs. 57*).—This report supersedes Bulletin 223 on the same subject published in 1904. It deals with the mineralogy, geology, and methods of analyses of gypsum, with its mining and milling as an industry, and describes the deposits in the different States. It is noted that from 1904 to 1918 there was an increase of over 300 per cent in the production of gypsum in the United States.

A bibliography is appended.

Tests on the fertilizing value of dolomagnesium, L. MAUME (*Prog. Agr. et Vitic.* (*Ed. l'Est-Centre*), *41* (*1920*), *No. 34, pp. 179–183*).—Tests of so-called dolomagnesium containing equal proportions of lime and magnesia on potatoes, onions, and cabbage in heavy soil rich in lime are reported.

It was found that an addition of dolomagnesium at the rate of 1,000 kg. per hectare (890 lbs. per acre) increased the potato crop by one-third over plats treated with manure alone, while an addition of 2,000 kg. per hectare increased the crop by one-half. The dolomagnesium had a distinctly injurious effect on onions. An addition of 1,000 kg. per hectare of dolomagnesium to cabbage resulted in only a small increase in crop, while an increase of from two-thirds to four-fifths was obtained by additions of 2,000 kg. per hectare.

It is concluded that the effectiveness of dolomagneisum varies considerably with cultural methods and conditions.

Sulphur as a fertilizer, C. A. SHULL (*Science, n. ser., 52* (*1920*), *No. 1347, pp. 376–378*).—A brief review of work at the different State experiment stations on the use of sulphur in different forms as a fertilizer is given, in an argument for testing the value of sulphur on soils generally throughout the country.

Borax fertilizer experiments show striking results, A. W. BLAIR (*N. J. Agr., 2* (*1920*), *No. 10, pp. 12, 13, figs. 2*).—Experiments conducted by the New Jersey Experiment Stations in cooperation with the U. S. Department of Agriculture on the influence of borax on the potato crop when mixed in different amounts with a standard fertilizer mixture are reported, showing that 30 lbs. of anhydrous borax per acre had only a slightly depressing effect on the yield even when applied in the row at the time of planting.

Fifty pounds of borax had only a slightly depressing effect when applied in the drill three weeks before planting. When applied in the drill at the time of planting there was definite injury and a decidedly depressed yield. Applications of 100 lbs. or over of borax per acre practically ruined the crop. Applying the fertilizer about three weeks before planting the potatoes reduced to a marked degree the toxic effect of the borax.

Commercial fertilizers, 1920, C. D. WOODS (*Maine Sta. Off. Insp. 97* (*1920*), *pp. 65–88*).—This contains the results of actual and guarantied analyses of 245 samples of fertilizers and fertilizer materials and 4 samples of lime collected for inspection in Maine during 1920, together with a brief discussion of the State fertilizer inspection law.

Inspection of commercial fertilizers, P. H. WESSELS (*Rhode Island Sta. Ann. Fert. Circ., 1920, pp. 3–11*).—This circular contains the results of actual and guarantied analyses of 73 brands of fertilizer materials, 3 samples of wood ashes, and 2 samples of lime offered for sale in Rhode Island during 1920.

The international movement in fertilizers and chemical products useful to agriculture (*Internatl. Inst. Agr. [Rome], Doc. Leaflets, 4 (1920), No. 2, pp. 40*).—This review deals with the world production of and trade in chemical fertilizers and chemical products useful in agriculture for the year 1919, as compared with the five previous years. Data on consumption are also included.

These data are allocated in five chapters dealing with phosphatic, potassic, and nitrogenous fertilizers, unclassified chemical and other fertilizers, and sulphur and copper sulphate. No data are given on potash production in Germany for 1919. Alsace produced 92,006, the United States 29,408, and British India 17,497 metric tons. The two last nations showed a marked decrease in potash production as compared to 1918. The United States was the greatest producer of natural phosphates, while Great Britain and Ireland produced the most basic slag and superphosphate of lime.

Proceedings of the twenty-seventh annual convention of the National Fertilizer Association (*Natl. Fert. Assoc. Proc. Ann. Conv., 27 (1920), pp. 116*).—These proceedings contain among other things a number of brief special papers on matters relating to fertilizers and soil fertility.

AGRICULTURAL BOTANY.

Report of the plant physiologist, E. M. R. LAMKEY (*Delaware Sta. Bul. 125 (1919), pp 28–30*).—In continuation of a previous report (E S R., 41, p. 132), the author reports progress on his studies of changing permeability and its relation to availability in the peach. Additional experiments have specifically indicated that peach tissue may be equally permeable to the members of a given group of salts under one system of soil treatment, but unequally permeable to the various members of this group under another system. Furthermore, these same salts may exert a secondary effect upon the membrane, which not only affects the permeability as applied to these salts but also affects the permeability in regard to other substances. In general, the cations or positive elements of chemical compounds are found of chief value in effecting the permeability of the tissue. However, the anions of some compounds influence permeability, but to a less marked extent.

In the studies on the reaction of enzyms within the plant, peroxidase, oxidase, invertase, and diastase activities are being investigated. It has been found that the anions of chemical compounds have the greatest effect upon enzymatic activity.

From the investigation upon the enzymatic activity as a limiting factor in production on sweet pea, corn, and garden peas the author concludes that certain oxidation and reduction processes are closely associated with various phases of production and food formation.

The influence of cold in stimulating the growth of plants, F. V. COVILLE (*Jour. Agr. Research [U. S.], 20 (1920), No. 2, pp. 151–160, pls. 16*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the author describes experiments and records observations on the effect of chilling during dormancy on the resumption of growth in some native species of trees and shrubs. It is claimed that such plants will not resume normal growth in the warm spring weather unless they have been subjected to a period of chilling. The effect of cold on dormant plants is believed to be intimately associated with the transformation of stored starch into sugar. In explanation the author suggests that the starch grains stored in the cells of the plant are at first separated by the living and active cell membranes from the enzym that would transform the starch into sugar, but when the plant is chilled the vital

activity of the cell membrane is weakened so that the enzym leaks through it, comes in contact with the starch, and turns it into sugar.

Influence of high temperature on the vitality of seeds of Trachycarpus excelsa, N. Passerini (*Bul. Soc. Bot. Ital., No. 1 (1919), pp. 9–11*).—Of 16 lots (100 each) of seeds of the hemp palm (*T. excelsa*), lots 1 to 7 were placed on March 29, 1915, for 10 minutes in water, the temperature of which ranged by tens from 40 to 90° C., and then up to 98.6°, the temperature of boiling at the altitude of the laboratory. The percentages of seed found to be dead on July 6 were 13, 19, 13, 89, 100, 100, 100. Lots 8 to 15, kept for 10 minutes in dry air at temperatures ranging by tens from 40 to 110°, inclusive, showed by July 6 mortality percentages of 12, 26, 7, 20, 30, 44, 62, and 73, respectively. Lot 16, the untreated control, showed a loss of 14 seeds, or 14 per cent. The relative resistance to dry heat is considered noteworthy.

The influence of external concentration on the position of the equilibrium attained in the intake of salts by plant cells, W. Stiles and F. Kidd (*Roy. Soc. [London] Proc., Ser. B, 90 (1919), Nos. B 632, pp. 448–468, figs. 6; B 633, pp. 469, 470*).—The work recorded in this paper forms the first installment of an attempted analysis of intake and translocation of solutes by the living plant. The experiments employ such plants as have storage organs and deal with the absorption by the plant tissue of salts presented thereto singly, more especially with the position of equilibrium attained in this intake of the salt and the influence of the concentration of the salt, both on the rate of absorption and on the position of the equilibrium.

The course of intake of salts by carrot and potato tissue has been followed by measuring the changes in conductivity of the solution of salt presented to the tissue, the concentrations of each salt employed varying from N/10 to N/5000. In case of copper sulphate, exosmosis exceeds absorption in all concentrations of copper sulphate. This is characteristic of toxic substances. The initial rate of exosmosis increases with increase of concentration of the toxic solution. Exosmosis from carrot into distilled water is slight, that from potato considerable, carrot being, therefore, the more suitable subject for following absorption by the conductivity method.

Both carrot and potato tissue absorb potassium, sodium, and calcium chlorids in all concentrations examined, absorption being at first approximately proportional to the external concentration but later progressing to an equilibrium condition in which the ratio of internal to external concentration varies with the concentration. The ratio of final internal to final external concentration (absorption ratio) is many times unity with low external concentrations, but with increasing concentration the ratio diminishes, reaching eventually a value much less than unity. The data obtained are regarded as inadequate to justify the conclusion that absorption of salts by the cell is an adsorption process.

The comparative rate of absorption of various salts by plant tissue, W. Stiles and F. Kidd (*Roy. Soc. [London] Proc., Ser. B, 90 (1919), No. B 633, pp. 487–504, figs. 7*).—The method here employed was that described in the paper above noted, the experiments being carried on in triplicate.

It was found that carrot in nutrient or harmless solutions remained turgid throughout the experiments. In each series the salts had a common anion or cation. Four series with carrot and three with potato were carried out, the common ions in the carrot series being potassium, chlorid, sulphate, and nitrate, in the potato series the last three.

The rate of absorption was measured by the electrical conductivity method previously described. After a brief initial period, lasting only a few hours, of rapid withdrawal of salt from solution, there follows a long period, lasting

several days, during which absorption proceeds to an equilibrium, the curve following an approximately logarithmic course.

The orders of absorption of cations and anions are indicated. It appears clear that the rate and extent of intake of one ion of a salt may be influenced by the nature of the other ion. The bearings of results obtained upon the findings of other writers are discussed.

Effects of salts upon oxidase activity of apple bark, D. H. Rose, H. R. Kraybill, and R. C. Rose (*Bot. Gaz., 69 (1920), No. 3, pp. 218–236, figs. 5*).—The authors state that 0.1 N solutions of all the chlorids tested (potassium, sodium, lithium, cæsium, ammonium, calcium, manganese, ferric) decreased oxidation of pyrogallol by apple bark powder. Oxidation was increased very slightly by 0.1 N solutions of all the sulphates tested. Nitrates of potassium, sodium, and magnesium (0.1 N) had practically no effect on oxidation, which was decreased by nitrates of calcium, barium, manganese, and iron (ferric). Potassium chlorid (0.02 N and 0.002 N) did not affect oxidation, which was, however, increased by manganese chlorid in each concentration. Oxidation was also increased by tartrates, oxalates, citrates, acetates, and carbonates.

Marked increase in oxidation in these cases seems to be due, in part at least, to the low acidity of the mixtures of bark, pyrogallol, and salt. Marked decrease in oxidation is not necessarily accompanied by high acidity of the mixtures. Ions other than the hydrogen and hydroxyl may be important in regulating oxidase activity. In neutralizing hydrogen or hydroxyl ions, it is important to take into consideration, in the study of oxidase activity, the possible effect of the salts which may be formed. Chlorids which retard the combustion of tobacco at high temperatures also retard the oxidase action at low temperatures. The effect of alkali chlorids upon oxidase acidity suggests a practical application in preventing the browning of fruits and vegetables in canning, preserving, or drying.

The reducing activity of the roots of Graminaceæ: The reduction of calcium nitrate, I, II, G. Sani (*Atti R. Accad. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 28 (1919), II, No. 5–8, pp. 199–201, 244–247*).—Following a discussion of conclusions previously reported by the author (E. S. R., 24, p. 229), it is suggested that since phosphorus, sulphur, potassium, and nitrogen, given to the plant in combination with oxygen, are afterwards met with in the form of compounds mostly poorer in oxygen, the processes of reduction in nature may correspond to an accumulation of new and complex organic substances. Data are given as to the constituents and implied changes therein, particularly the reduction of calcium nitrate, in the case of cereals.

The carbohydrate economy of cacti, H. A. Spoehr (*Carnegie Inst. Wash. Pub. 287 (1919), pp. 79, figs. 2*).—The purpose of this work was primarily to gather materials for a study of the problems of photosynthesis. Experiments in progress at the Desert Laboratory at Tucson for several years have indicated the need of a clearer understanding of the conditions governing the equilibria and mutual transformations of the groups of carbohydrates in the leaf and of the fate of the substances in metabolism, as prerequisite to a rational discussion of the problems bearing upon the manner in which sugars are formed in the leaf. The avenue of approach now regarded as most promising is that employing chemical conceptions and methods.

This paper comprises the results of investigations carried out during 1916–1918 to determine the nature of the carbohydrates of the cacti and embodies largely analyses of plants which had been subjected to various experimental conditions.

It seems that the material used in respiration of most of the higher plants is essentially of carbohydrate nature. Whether plants use only carbohydrates

in the course of normal respiration has not been established. Probably proteins and their simpler derivatives, incorporated in the cell substratum or medium as here conceived, produce therein the necessary conditions under which glycolysis may proceed, or through the production of acid and alkaline products regulate the enzymatic activities. These products are in turn again synthesized into the protoplasmic proteins, so that relatively small amounts of protein suffice for the conversion of large quantities of carbohydrate, and probably the major portion of the energy released is thus to be ascribed to the catabolism of the carbohydrates.

The greater portion of this work as here recorded was done with *Opuntia phæacantha*, known locally as *O. blakeana*. The method and particulars of procedure, as well as observed results, are given in detail. The successive sections of the report of this work deal with the carbohydrates of the cacti, seasonal variations in the carbohydrate content, the effect of water and temperature thereon, aerobic and anaerobic respiration, consumption of carbohydrates during starvation, and the origin and rôle of pentose sugars.

The vertical growth of trees, R. H. CAMBAGE (*Roy. Soc. N. S. Wales Jour. and Proc., 52 (1918), pp. 377–384*).—This paper deals with the question of whether or not the trunk of a tree continues to lengthen among or below the branches while it increases in girth, or whether the increase in height is due wholly to growth at the tree top. Observations and discussions are cited.

Measurements as carried out by the author during some years on very young trees, by placing tacks at regular intervals measured from a fixed level, indicate that the extension of the stem is made at the summit or growing point of the plant, and not among the branches, at least during the first few years of growth. The nails or tacks placed in the stems at any distance apart retained their relative positions irrespective of the total height acquired by the tree.

On the occurrence of multinucleate cells in vegetative tissues, R. BEER and A. ARBER (*Roy. Soc. [London] Proc., Ser. B, 91 (1919), No. B 635, pp. 1–17, pl. 1, figs. 2*).—Binucleate or multinucleate cells have been observed by the authors in 117 species (representing 60 families), which are listed. They state that multinucleate cells are characteristic of young tissues actively carrying on the processes of life. Careful study applied to more than 100 species has convinced them that the several nuclei have arisen by mitotic division, no instance of direct nuclear division having been observed in these young active tissues.

The fate of the nuclei in multinucleate cells varies in the different species. In some cases the plurality of nuclei may persist to a late stage. No instance of nuclear fusions as factors in the reduction of the number of nuclei has been observed. Numerous cases are noted in which the occurrence of multinucleate cells marks a normal and definite stage in the development of the parenchymatous tissue. No species of flowering plant examined was entirely free from multinucleate cells, which are therefore considered a normal feature in the growth of most of the higher plants.

It is concluded that in some or all of the ways mentioned the multinucleate condition is of direct or indirect value to the plant.

Spermatogenesis in Blasia, L. W. SHARP (*Bot. Gaz., 69 (1920), No. 3, pp. 258–268, pl. 1*).—This account of the spermatogenesis in *B. pusilla* is said to be based upon preparations made from a limited amount of material collected near Chicago several years ago. It is stated that centrosomes are present in Blasia at all stages of the mitosis which differentiates the androcytes, and in the androcytes they persist and function as the blepharoplasts. The transformation and associated changes involved are discussed.

Vital coloration in plant cells, I, E. Küster (*Ztschr. Wiss. Mikros. u. Mikros. Tech., 35 (1918), No. 2, pp. 95–100*).—Briefly outlining experiments constituting preliminary tests of the method previously noted (E. S. R., 27, p. 632) of coloring living cells, the author states that nontranspiring and normally turgescent living plant organs or parts thereof lend themselves readily to staining. Sufficiently high concentrations give a quick and intense coloration. Transpiration assists in the distribution of the colorant.

Coloring matters of plants (*Nature [London], 105 (1920), No. 2631, pp. 139, 140*).—This is a compact synthesis of information regarding the water-soluble plant pigments and their significance. These pigments are subdivided into two groups, first, derivatives of flavone or of flavonol (anthoxanthins), and second, the anthocyans. The sources, relationships, and significance of both of these groups are discussed, as are likewise other colored compounds in plants of interest in view of the recent shortage of synthetic dyes.

A genetical study of flower form and flower color in Phlox drummondii, J. P. Kelly (*Genetics, 5 (1920), No. 2, pp. 189–248, pls. 2, figs. 15*).—This paper is based on experimental data obtained since the spring of 1914.

It is stated that since the introduction of *P. drummondii* into culture, less than 85 years previously, a large number of variations have occurred, affording good opportunity for the genetical analysis of the species. A variation named *cuspidata*, which proved to be hereditary, has been studied, and it is stated that the difference of a single gene distinguishes the entire-petaled from this cuspidate-petaled kind. The *cuspidata* gene is thought to act (chiefly) to decrease the rate of epidermal growth, this inhibition being weaker in three locations. Another hereditary variation in the form of the flower is represented by the funnel-shaped phloxes which are also set apart by a single factorial difference.

It is stated that there are pairs or sets of complementary factors in *P. drummondii*. In some cases, in addition to the compound or interacting effect, the individual members of the pairs or sets are capable of separate and distinct somatic expression. The simultaneous presence of three factors is said to be necessary to the production of a simple blade color. The simple type of blade color caused by the presence of the minimum complement of the three necessary factors varies somewhat, depending presumably on the character of the chromogen base present. Certain modifying factors are discussed. Dark-eyed forms differ from light-eyed forms by a single factorial difference. The cream-colored condition is a simple recessive to the white-colored. The chromosome number in *P. drummondii* is 14 for the cells of the root-tip.

Genetic experimentation at Verrières, A. Meunissier (*Bul. Soc. Natl. Acclim. France, 65 (1918), Nos. 2, pp. 43–55, figs. 3; 3, pp. 81–90, figs. 2; 4, pp. 115–121, fig. 1; 5, pp. 134–136; 6, pp. 174–180*).—A review is given of historical developments since the rediscovery of Mendel's law in 1900. This is followed by an account of studies at Verrières applied to a considerable number of pairs of characters in the garden pea, wheat, oat, barley, maize, beet, crucifers, bean, onion, potato, and various ornamental and other plants, besides a few animals.

The nature of the diœcious condition in Morus alba and Salix amygdaloides, J. H. Schaffner (*Ohio Jour. Sci., 19 (1919), No. 7, pp. 409–416*).—The author made a study of diœciousness, employing for this purpose white mulberry and peach leaf willow growing spontaneously along ravines in Clay County, Kans.

Of the 66 mulberry trees, 28 were apparently pure carpellate, 24 pure staminate, and 14 intermediates; the intermediates varying in degree as regards tendency toward the carpellate or staminate condition. One case, that of a wild seedling about 20 years old, showed an example of the reversal of the

sex qualities in the vegetative conditions in a bud. This case is accepted as evidence that sex reversal can and sometimes does take place in an old tissue whose cells are removed by thousands of vegetative divisions from the original zygote, and as proof that sex control is only a matter of finding out how to change the prevailing physiological state of the tissues in some way corresponding to the change actually occurring in living bodies without any apparent external cause. It is considered reasonable to believe that a change in sexual state could be accomplished much more readily in the zygote, or the cells coming immediately from it, than in an older tissue where the particular condition presumably has been intensified by its longer continuance, whether the state is due to accumulated chemical bodies or to some other cause.

Of about 100 willows examined, all were apparently staminate or carpellate except 9 intermediate individuals, to which critical study was applied. All of these seemed to be primarily staminate, ranging from a few to many carpellate catkins or bisporangiate catkins on a plant. One individual, though prevailingly staminate, had a considerable proportion of carpellate or fruiting catkins and produced considerable seed. In most cases the carpellate catkins were staminate below, becoming carpellate toward the outer end with the transition zone apparently neutral, in which abnormal flowers were frequent. The development in such a zone indicates that the differential sexual state is not sufficiently strong in either direction to make the factors which control the expression in that direction entirely latent or entirely active. Reversal of sexual state is not abrupt but gradual and is regarded as a quantitative change.

The conclusion from the evidence here presented is that sex expressed as maleness or femaleness is not an irreversible, Mendelian, hereditary character, dependent of the presence of a single hereditary factor or group of factors, but that sex is a physiological state or condition which influences the activity and latency of the factors that control the development of sexual gametes or organs, or other sexual peculiarities possessed by the organism.

Studies in the pollination of Indian crops, I, A. and G. L. C. Howard and A. Rahman (*India Dept. Agr. Mem. Bot. Ser., 10 (1919), No. 5, pp. 195–220, pls. 5, figs. 3*).—Since the publication of a previous paper (E. S. R., 24, p. 723), a number of additional crops have been investigated. The present paper deals with the results of these studies, obtained as far as the end of the rabi harvest of 1919, on san-hemp (*Crotalaria juncea*), pigeon pea (*Cajanus indicus*), Java indigo (*Indigofera arrecta*), Sumatrana indigo (*I. sumatrana*), linseed (*Linum usitatissimum*), taramira (*Eruca sativa*), til (*Sesamum indicum*), niger (*Guizotia abyssinica*), jute (*Corchorus capsularis* and *C. olitorius*), and roselle (*Hibiscus sabdariffa*).

A study in pollination (*Agr. News [Barbados], 19 (1920), No. 470, p. 141*).—Noting the above body of information, this deals more particularly with the pigeon pea (*Cajanus indicus*), two varieties of which as described are said to be cultivated in India.

Studies in mustard seeds and substitutes.—I, Chinese colza (Brassica campestris chinoleifera), A. Viehoever, J. F. Clevenger, and C. O. Ewing (*Jour. Agr. Research [U. S.], 20 (1920), No. 2, pp. 117–140, pls. 10*).—The authors report that material imported as rape seed and sold as mustard seed has been identified as Chinese colza, *B. campestris chinoleifera* n. var. Studies have been made of the seed and plants, the characteristics of the seed have been established, and means pointed out for their identification and differentiation from true mustard seed. Plants grown from the seed were found to be closely related to the colza group, *B. campestris*. The volatile oil obtained from the material was identified as crotonyl isothiocyanate, which is not a suitable sub-

stitute for mustard oil, either for condimental, bactericidal, or medicinal purposes. The fixed oil proved to be of the general composition of the rape oils, and the quantity of oil present indicated that the seed would prove valuable as an oil seed. On the basis of the general composition of the seed and the character of the volatile oil, it is believed that the pressed oil cake might be used as a stock feed. The leaves are said to be succulent and should be of value as greens. The plants are vigorous and hardy and are considered to offer possibilities as a forage crop. A technical description of the variety is given.

A bacterium in the roots of Diplotaxis erucoides, R. Perotti (*Atti R. Accad. Lincei, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 28 (1919), I, No. 9–10, pp. 331–335*).—An examination of *D. erucoides*, popularly supposed to add to the fertility of the soil, showed the presence in a certain region of a bacterium which is partially described although not identified.

Air pollution by coal smoke, A. G. Ruston (*Jour. Min. Agr. [London], 27 (1920), No. 1, pp. 69–77*).—This report deals with a comparison of domestic and boiler soot; impurities in the air due to smoke; the effects of smoke on the growth of plants; the effect of acid in soot on the growth of plants; sulphuric acid in rain water; the effect of acidity on soil bacteria; the effect of acid conditions on grass land; deficiency of lime due to acidity in soil; economic effects of smoke pollution; and electrification experiments.

Higher temperature and stronger draft in factory furnaces give soot having more ash and less tar than are contained in the smoke from domestic grates.

Studies on the contents of smoke from ten representative stations in Leeds, and one on the university experimental farm 7.5 miles east, show that impurities diminish rapidly northward from the industrial area into an agriculture area, being 20 times more abundant in the center of Leeds. The most deleterious of all suspended impurities is tarry matter, in which the extra-urban suspended material was much richer.

Solid materials play a very important part in affecting detrimentally the growth of plants. This result is due to diminution of sunlight as regards both hours and intensity; to clogging of the stomata with oil or tar, particularly noticeable in case of conifers, owing to their having sunken stomata; and to the deposit of a sort of varnish on the whole leaf surface.

The samples of soot showed on testing the presence of free mineral acids, the amount of which in the center of Leeds ranged as high as 80 lbs. per acre. It is thought that in these parts the leaf works at less than half its normal rate at best during its active period, which is shortened by six weeks.

The presence of smoke contamination is usually manifested by increased sulphur content in the leaves of trees. Observations at Leeds show increased deposit of sulphur compounds with the soot upon the surface as well as increased intake of sulphur dioxid, which passes rapidly into H_2SO_4.

Grasses supplied with water having 32 parts H_2SO_4 in 100,000 were killed in three months, and no trace of vegetation appeared in the following spring on such areas; 16 parts in 100,000 proved fatal in less than one year, smaller proportions reducing both quantity and quality of the herbage. Moreover, larger amounts of acidity corresponded always to decreased yield, increased fiber content, and decreased protein content.

In the soil the most marked result was a reduction in the number and activity of the soil bacteria, the most valuable and sensitive of which are the nitrifying organisms. These were reduced as to activity more than 88 per cent, while the activity of ammonia-producing organisms was reduced by 42 per cent.

The results of interference with normal activity is seen in the accumulation of matted roots in many old pastures, particularly in the smoke-infected areas.

Grassland underlaid by a sort of peaty mat of undecayed substance absorbing water and preventing utilization of rainfall is very subject to drought. Heavy additions of lime are needed to neutralize the acidity of soils on coal measures, determined by removal of the lime in the soluble form of calcium-sulphate. Available lime is thus greatly decreased in some sections.

The low lime content of the milk produced in these industrial areas is said to be a matter of considerable importance. The total economic effects of smoke pollution with its deposits of tar and acid are also enormous. Leguminous plants and finer grasses disappear and coarser and less valuable plants take their places, giving decreased returns in smoky areas. The stock-carrying capacity of pastures may be reduced as low as one-sixth its former value.

Experiments at Garforth showed that electrification of the atmosphere causes a heavier deposition of soot particles, these particles acting as nuclei for other smoke products. This circumstance overbalances any good effect that may be due to electrification.

FIELD CROPS.

[Report of field crops work in Delaware, 1919], A. E. Grantham (*Delaware Sta. Bul. 125* (*1919*), *pp. 8–12*).—The continuation of work previously noted (E. S. R., 41, p. 136) is described.

Results secured in wheat variety trials are said to correspond closely with those of previous years. Bearded varieties continued to produce more dependable yields and also to show a greater tendency to tiller than smooth varieties.

In fertilizer tests and rotations, phosphoric acid and potash applied in the 4-year rotation of corn, soy beans, wheat, and grass have given more profitable returns with wheat than any other combination of fertilizers. The same application combined with green manure and lime is considered ideal for corn or the continuous growth of wheat on this type of soil. Wherever potash was used with wheat the kernels were better filled and of better quality than where any other combination was applied.

The results secured in rotations indicate that potatoes and soy beans left the land in an ideal condition for high wheat yields. Where a good rotation was followed, nitrogen was not profitable in a fertilizer for wheat, as this element could be supplied most economically by a sod or green manure, provided the wheat could be seeded early enough in the fall. Crimson clover and red clover are said to have a marked influence in effecting high corn yields in rotations.

In other studies of the adaptability of various crops for green manuring purposes, it is noted that in spite of the unusual mildness of the winter of 1918–19 sweet clover was almost entirely lifted from the ground, while alfalfa survived the winter satisfactorily. Early seeding of sweet clover is advised to avoid heaving action of frost in the Sassafras silt loams. Comparisons of crimson-clover seed of different origin conducted in cooperation with the U. S. Department of Agriculture demonstrated that Italian seed was more vigorous and gave slightly higher yields than French seed, which in turn proved better than native seed. These results are held to indicate that foreign crimson-clover seed is fully as satisfactory as native seed, provided it is free from weeds.

[Report of field crops work in Iowa, 1919] (*Iowa Sta. Rpt. 1919, pp. 10–14, 25, 26, 35*).—The further progress of work previously noted (E. S. R., 41, p. 226) is described.

Results of cooperative tests of the annual sweet clover developed by this station demonstrate this legume to be of value for the country at large as well as Iowa and the corn belt. Tests of Iowar, a new and promising oat va-

riety, show it to be 3 days later, 3 to 4 in. taller, and to give a yield of 3 bu. more than Iowa 103. It is stated that over 1,000,000 acres of Iowa 103 and Iowa 105 oats were grown in the State and probably over 500,000 outside the State during the period reported. Iowa 1946, a new winter wheat variety, proved its hardiness by surviving an unusually severe winter with practically no winterkilling.

Winter wheat sown November 14 and 21 made satisfactory yields, following a severe winter, while early seedlings were almost entirely winterkilled. Although very late seeding of winter wheat is not recommended in preference to early seeding in the State, it is considered much safer than seeding in the middle of October.

Early maturing varieties of oats, Iowa 105, Iowa 103, and Kherson, seeded with clovers and alfalfa have given much better stands of the legume crops than the varieties of later maturity, as represented by Silver Mine, Green Russian, and Swedish Select.

Manchu and Black Eyebrow gave the best results in cooperative tests of soy bean varieties, except in the extreme north, where Ito San of somewhat earlier maturity seemed more satisfactory.

Weed seeds buried in the soil in the fall of 1911 were subjected to vitality tests in the greenhouse in March, 1919. Four kinds of seeds responded, germinating as follows: Velvet weed, 34 per cent; honey locust, 4 per cent; curled dock, 38 per cent; and *Amaranthus retroflexus*, 2 per cent.

Lambert Early, with a yield of 6 tons of roasting ears or a gross return of $90 per acre, was first in 1919 sweet-corn tests.

[Work with field crops at the Newlands Experiment Farm in 1919], F. B. HEADLEY (*U. S. Dept. Agr., Dept. Circ. 136 (1920), pp. 7–11*).—The progress of varietal and cultural tests conducted in continuation of work previously noted (E. S. R., 43, p. 435) is reported.

Coast barley with an acre yield of 22.4 bu. was highest in 1919 barley tests, and also led with a 5-year average of 34.6 bu. Bluestem with 15.4 bu. led the 1919 wheat test, while Little Club, with an average of 42.1 bu., was first during the period 1915–1919.

Fusarium blight is considered the probable cause of the decline of the potato industry on the project, only 152 acres being planted in 1919. Irish Cobbler, with 63 lbs. of marketable potatoes per 100-ft. row, led in 1919 variety tests, while Burbank, with an average of 79 lbs., led during the period 1914–1919. Results of three years' time of planting tests indicate the optimum planting date to range from the middle of April to the middle of May. Distance of planting tests where seed pieces were dropped at distances from 6 to 24 in. in the row showed a gradual decline in total production with increase of distance, but the distance of planting did not materially affect the result when marketability was considered, as the culls increased with closer planting. The customary spacing, 18 in., was considered desirable. Whole seed produced better than cut seed and halved seed better than quartered, but planting whole seed of large potatoes is not considered economical on account of the greater quantity of seed used. Large potatoes cut produced a decidedly net higher yield than either medium or small seed either whole or cut. Whole seed of medium-sized tubers returned a slightly larger net yield than either medium or small seed cut, and also a larger yield than from small potatoes planted whole.

[Field crops work in Porto Rico in 1919], W. P. SNYDER, H. C. HENRICKSEN, and W. A. MACE (*Porto Rico Sta. Rpt. 1919, pp. 28–31, 31–34, 36, 37*).—Sugar cane work consisted of variety tests and production of seedling canes. Kavangire, a Japanese cane, with a calculated yield of 83.56 tons of cane per acre, was the highest producer, putting forth immense stools of very slen-

der canes. Although resistant to mottling, it is not likely to be favored commercially on account of the low sucrose content of the juice and the difficulty encountered in harvesting the slender canes. Its practical self-sterility and consequent adaptation to hybridization with pollen-fertile varieties should render it valuable in breeding new varieties. Other varieties of promise include B. 1753, G. C. 1480, G. C. 1486, and Java 36. The last named, like Kavangire, exhibited strong resistance to the mottling disease.

Experiments with legumes included bean selection and hybridization studies, and variety and cultural tests with cowpeas, soy beans, and mungo beans. Black Venezuelan beans produced nearly twice the yields of either Santo Domingo brown or Porto Rico red beans. The mungo bean (*Phaseolus mungo*) is considered of value to the small planter as it resists drought and excessive rains much better than the ordinary bean.

Corn work was confined to correlation and type studies. Seed from the Virgin Islands yielded less, was softer, and was much more readily attacked by weevils than the Porto Rican varieties.

Considerable data dealing with the time of planting and the distribution of acreages of food crops on the island are set forth in detail. The several crops studied with their respective acreages include corn 80,000 acres, rice 22,000 acres, field beans and cowpeas 118,000 acres, pigeon peas 23,000 acres, sweet potatoes 55,000 acres, yautias 22,000 acres, cassava 14,000 acres, and yams 7,000 acres.

[Report of field crops work in Barbados, 1917–18], J. R. BOVELL (*Barbados Dept. Agr. Rpt., 1917–18, pp. 2–26*).—This describes the continuation of work with sugar cane, cotton, cassava, economic Colocasieæ and Xanthosomas, various legumes, yams, sweet potatoes, and miscellaneous fodder crops along the same general lines as previously noted (E. S. R., 40, p. 434).

[Work with field crops in Guadeloupe, 1918–19], J. S. DASH (*Guadeloupe Rap. Sta. Agron., 1 (1918–19), pp. 14–22, figs. 2*).—Limited variety tests and field trials conducted by the Guadeloupe Agricultural Station with sugar cane, cotton, castor beans, and miscellaneous grain and forage crops are outlined.

[Work with field crops in Northumberland County, England], D. A. GILCHRIST (*County Northumb. Ed. Com. Bul. 31 (1920), pp. 48–78, pl. 1*).—This describes the continuation of rotation, fertilizer, and variety tests with field crops in 1920 along the same general lines as previously noted (E. S. R., 41, p. 729).

[Report of field crops work in Bihar and Orissa, India, 1918–19] (*Bihar and Orissa Dept. Agr. Rpt., 1918–19, pp. 3–6, 9, 13, 15–22*).—This describes the continuation of work along the same general lines as that previously noted (E. S. R., 40, p. 825).

[Field crops work in Travancore, India, 1918–19], N. K. PILLAI (*Travancore Dept. Agr. and Fisheries Rpt. 1918–19, pp. 7–16, 20–24, 44–47, 50*).—The report describes the progress of variety and fertilizer tests with rice, sugar cane, and cassava; breeding work and hybridization studies with rice; and seeding experiments with cassava.

[Report of field crops work in Nigeria in 1919], P. H. LAMB, A. H. S. VIGO, and T. THORNTON (*North. Provs., Nigeria, Agr. Dept. Ann. Rpt., 1919, pp. 1–4, 12–20*).—The continuation of variety, cultural, and fertilizer tests with field crops along the same general lines as previously noted (E. S. R., 43, p. 637) is discussed.

[Experiments with different meadow mixtures], S. RHODIN (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 204 (1920), pp. 26; also in K. Landtbr. Akad. Handl. och Tidskr., 59 (1920), No. 4, pp. 181–204*).—Cooperative experiments, conducted in various parts of Sweden with mixtures of different

grasses and of legumes and grasses, are described, and the results secured from 1909 to 1918, inclusive, are reported. The different species of grasses entering into the test were *Agrostis stolonifera, Alopecurus pratensis, Arrhenatherum elatius*, two species of Bromus, *Dactylis glomerata, Festuca arundinacea, F. pratensis, Phleum pratense, Poa pratensis*, and *P. trivialis*, while the leguminous plants included red clover, white clover, alsike clover, two species of vetch, two species of trefoil, and meadow pea (*Lathyrus pratensis*).

Botanical analyses of some of the meadows for different years, the dry matter, nitrogen, phosphoric acid, potash, and lime content of the hay from different meadows, and the quantities of nitrogen, phosphoric acid, potash, and lime removed in some of the crops are reported in tabular form and discussed. The botanical analyses of one field showed that timothy was reduced from 50 per cent of the stand the first year to 7 per cent the fifth year, and correspondingly, *F. pratensis* from 40 to 1.9 per cent, while *A. pratensis* was increased from 7 per cent the first year to 70 per cent the fourth and fifth years, and the combined stand of *D. glomerata, P. pratensis, A. stolonifera*, and clover from 3 per cent to 21.1 per cent. As a rule, the grass and clover mixtures produced the larger yields of hay. The results in general led to the conclusion that in the rigorous and dry climate of the region the common clover and timothy mixture, at least on clay soils, is one of the most reliable hay crops, and excels in uniformity of yield and feeding value of product.

Crimson clover: Its possibilities in Kentucky, E. J. KINNEY (*Ky. Agr. Col. Ext. Circ. 81 (1920), pp. 12, fig. 1*).—A brief treatise describing cultural methods and field practices deemed best for growing crimson clover for hay, pasture, and seed in Kentucky. Methods for the control of diseases and insects attacking the crop are briefly indicated.

Glucose and starch from maize, T. D. HALL and G. M. HAY (*So. African Jour. Indus., 3 (1920), No. 7, pp. 597–605*).—Brazilian Flour, Hickory King, and Chester County corn were included in this experimental study, which reports the determination of starch and glucose yields, soluble reducing carbohydrates in corn meal, nature of soluble carbohydrates, oil content and iodin values, and other analytical data.

The results obtained are discussed in detail, and, taking all things into consideration, the authors are inclined "to think that Hickory King and Chester County are better than Brazilian Flour corn for the manufacture of starch and glucose in South Africa, as at present they are so much more easily procurable in quantity, yield almost as much glucose, and have a smaller loss in grinding. Both Hickory King and Chester County are more easily grown on the average soil, and yield more heavily than Brazilian Four corn."

Report on the maintenance and improvement of the quality of Egyptian cotton and the increase of its yield, H. M. LEAKE (*Cairo: Govt. Press, 1920, pp. IV+38, pl. 1*).—The author reviews the economic conditions influencing the determination of value of the raw material in the cotton trade of Egypt, outlining what he deems to be the fundamental considerations for the development for a sound policy on the part of the producer.

From a research standpoint, four primary lines of investigation, including economic, botanical, agricultural, and commercial are recognized, together with certain collateral lines comprising entomological, mycological, bacteriological, and physical investigations. These lines are discussed, and the essential points of an organization for the development and introduction of improved cottons on a commercial scale under conditions which will maintain a sufficient degree of purity, are indicated. He concludes with recommendations leading to "the maintenance and improvement of the quality of Egyptian cotton and the increase of its yield." In summarized form, these are as follows:

Maintenance of the purity of Sakel; the establishment of one or more types with the same intrinsic merits of Sakel, but with an improved vegetative habit; the maintenance of the present classes by a system of purification and establishment of pure races; the development of types agriculturally better suited to the environment, including the demarcation of type tracts; the development of a class of cotton superior in quality to the best Sakel; the division of the country into districts determined as far as possible by climatic considerations, and each with its experimental farm; the establishment of a seed farm in each district so defined; and the introduction of a system of licensing persons desiring to introduce new varieties.

Report on cotton experimental work in Mesopotamia, 1918 and 1919, R. THOMAS (*Mesopotamia Agr. Dir., Cotton Expt. Work Rpt., 1918–19, pp. 59, pls. 3*).—This report presents detailed descriptions of variety, date of planting and cultural tests, and work with cotton selections conducted at Bagdad, Amarah, Baqubah, Hillah, and Mosul in Mesopotamia, and discusses at some length the possibilities of Mesopotamia as a cotton-growing country. Considerable tabular data, including soil analyses, meteorological records, valuation and spinning tests of the 1918 crop, and detailed notes on the varieties and selections used in the various tests are appended, together with an outline map of Mesopotamia, indicating principal cities, perennial irrigation areas, and railroads.

How to compute lint cotton yields, W. E. AYRES (*Prog. Farmer, 35 (1920), No. 37, p. 1525*).—A contribution from the Mississippi Experiment Station presenting factors by which the average number of bolls on 30 ft. of row may be multiplied in order to obtain the number of pounds of lint per acre. Separate factors are indicated for each of 15 standard varieties when planted in rows 3, 3.5, 4, and 4.5 ft. in width.

Native fiber plants, G. SELLERGREN (*K. Landtbr. Akad. Handl. och Tidskr., 59 (1920), No. 4, pp. 235–259, figs. 14*).—An article, in continuation of one previously noted (E. S. R., 43, p. 828), discussing the value and uses of *Eriophorum vaginatum, E. angustifolium, E. latifolium, Typha latifolia, Cirsium palustre, Salix pentandra,* and *Populus tremula* as sources of fiber.

Flax growing experiments [in Ireland], 1915–1919 (*Ireland Dept. Agr. and Tech. Instr. Jour., 20 (1920), No. 3, pp. 351–361*).—Variety tests and breeding work with flax, conducted during the period 1915–1919, are reported. Fertilizer tests supplementing those previously noted (E. S. R., 38, p. 33), were also continued during the period. The results obtained in fertilizer tests from 1901 to 1915, inclusive, are presented, and may be summarized as follows:

Applications of potassium salts gave profitable increases, kainit and potassium chlorid proving better than the sulphate. These salts gave similar results whether applied in winter or at the time of seeding. Where used in conjunction with 0.5 cwt. of ammonium sulphate, dressings at the rate of 1.5 cwt. of potassium chlorid proved more profitable than 1 cwt.

Phosphatic fertilizers, alone, with potassium, or as part of a complete mixture encouraged weed growth at the expense of the flax, and their use was almost invariably attended by a loss, and very frequently even with smaller yields of scutched flax. The use of agricultural salt was not remunerative.

The varied results obtained from the use of slow-acting nitrogenous fertilizers, such as rape meal, when in a mixture with kainit did not recommend their uses in preference to either kainit or potassium chlorid alone. The use of ammonium sulphate alone proved less profitable than when combined with potassium chlorid, or potassium chlorid alone. Lime applied to the preceding crop of oats following sod gave increased yields of flax. Applications containing soluble

potassium fertilizers were the only kinds that prevented the flax sprouts from yellowing.

Flax culture in northern Africa, L. DUCELLIER (*Inst. Colon. Marseille, Bul. Matières Grasses, No. 4 (1920), pp. 153–172*).—An article discussing the field practices and cultural methods deemed best for growing flax in northern Africa and describing varieties considered most profitable for the region.

The culture of oil crops in Finland, G. GROTENFELT (*Landtbr. Styr. Meddel. [Finland], No. 129 (1920), pp. 37, figs. 31*).—The possibility and importance of growing oil crops in Finland are discussed, and directions for the culture of flax, hemp, and several cruciferous oil crops, including rape, turnips, and mustard, are given. The methods of extracting oil from the seeds of these crops and of preparing it for market are described.

The Research Institute for Potato Culture, H. W. WOLLENWEBER (*Deut. Landw. Presse, 47 (1920), No. 41, pp. 297, 298, figs. 5*).—This briefly describes and illustrates the activities of the German Research Institute for Potato Culture, located in Berlin-Steglitz.

Potato experiments in Bavaria, 1917–18, H. HAMPP (*Landw. Jahrb. Bayern, 8 (1918), No. 11–12, pp. 760–769*).—This reports results of variety, cultural, and fertilizer tests of potatoes in Bavaria, together with surveys of the distribution of different varieties in the several districts of the State, and notes on the prevalence of the important plant diseases.

Girdling experiments with the potato, BROILI (*Mitt. Biol. Reichsanst. Land u. Forstw., No. 17 (1919), pp. 17–19*).—Girdling or ringing potato stalks by wrapping wire several times around the stems about three or four leaves below the tops in such a manner as to inhibit the flow of sap is said to have produced a great increase in the number of seed balls. The girdling did not affect adversely the production of tubers on plants so treated.

Twentieth Century potatoes, J. FRASER (*London: Cable Printing and Pub. Co., Ltd., [1919], pp. 72*).—A publication comprising a descriptive list of about 817 potato varieties grown in the British Isles, indicating those immune to wart diseases and giving the more important synonyms.

Spraying Irish potatoes, R. W. LEIBY (*N. C. Agr. Col. Ext. Circ. 103 (1920), pp. 14, pl. 1, figs. 6*).—This circular notes the continuation of spraying experiments with the fall crop previously reported (E. S. R., 41, p. 532), and reports results of experiments with the early crop. Spraying with poisoned Bordeaux mixture at four points in eastern North Carolina resulted in a 2-year average increase of 71.7 bu. per acre over unsprayed plats. Spray formulas and brief instructions for their use on the early and late crops are included.

The cultivation of rice in Southern Rhodesia, H. G. MUNDY (*Rhodesia Agr. Jour., 17 (1920), Nos. 3, pp. 243–246; 4, pp. 320–324, pls. 2*).—The paper deals with the methods of cultivation and the nature of the rice crop grown by the natives in Southern Rhodesia, and compares the Rhodesian practices with those followed in India and California.

Modern rice culture from a technical and economic standpoint, H. PUTTEMANS (*Ann. Gembloux, 26 (1920), Nos. 7, pp. 315–325, figs. 4; 9, pp. 407–424, figs. 10*).—This article points out the characteristics of the modern methods of rice culture practiced in the Gulf States of the United States, and discusses the successful use of American methods of rice culture in Brazil and Argentina.

Preliminary report on experiments with wet rice in Krian, H. W. JACK (*Agr. Bul. Fed. Malay States, 7 (1919), No. 5, pp. 298–319, pls. 4*).—Experiments with rice, including variety and fertilizer tests, correlation studies, and breeding work, are reported, together with brief notes on the cultural methods practiced in the Federated Malay States, and diseases and pests attacking the crop in the region.

Results of the correlation studies indicated that a fairly systematic increase in the number of tillers per hill occurred as the number of plants per hill increased from one to four, but the number of spikelets per panicle tended to diminish, so that as the number of tillers increased the average yield per tiller decreased. If 10 per cent was allowed for experimental error, the yield per hill and acre was not materially altered, as the number of plants per hill was increased within the limits of from one to four plants. Plants on good soil transplanted but once produced approximately one-fourth the number of tillers brought forth by plants transplanted and split up three times. Under like conditions the grain yield is said to vary, within limits, in direct proportion to the number of transplantings, the optimum number in Krian being four. The number of tillers produced per plant was found to vary directly according to the space allowed per plant in transplanting into the fields, up to a spacing limit of 18 by 18 in. Spacing plants wider than this tended to produce too much vegetation and permitted luxuriant weed growth.

Growing and utilizing sorghums for forage, H. N. VINALL and R. E. GETTY (*U. S. Dept. Agr., Farmers' Bul. 1158* (*1920*), *pp. 32, figs. 18*).—The environmental adaptations of sorghum are described, and cultural methods and field practices considered best in growing the crop are outlined. The utilization of forage sorghums for hay, fodder, silage, pasture, grain, and soiling purposes is discussed in some detail, together with brief notes on prussic-acid poisoning in sorghums, diseases, insect pests, and composition and digestibility. The principal sorghum-producing areas in the United States are shown on an outline map and the most reliable varieties for grain and forage indicated for each.

Cane plant material, C. W. HINES (*Facts About Sugar, 10* (*1920*), *Nos. 17, pp. 332, 333, fig. 1; 18, pp. 352, 353, figs. 2; 19, pp. 372, 373, figs. 2*).—The author discusses the different means of propagating sugar cane, and outlines methods of selection, preparation, and planting applicable to both tropical and subtropical regions.

Proper width of rows for sugar cane, W. E. CROSS (*Rev. Indus. y Agr. Tucumán, 10* (*1919*), *No. 5–6, pp. 87–100, fig. 1; also in La. Planter, 65* (*1920*), *No. 15, pp. 233–235, fig. 1*).—This describes experiments with sugar cane at the Tucumán Experiment Station, giving the yields of cane and sugar from several varieties in rows spaced at distances ranging from 0.9 to 2.4 meters (3 to 7.9 ft.) apart, during the period 1916–1919. Conclusions from the results obtained may be summarized as follows:

Although with plant cane greater yields were secured with narrow rows, the yield of cane and sugar per hectare during the four years was approximately the same for all widths between 0.9 and 2.1 meters. The yield per hectare decreased in rows farther apart than 2.1 meters.

The average weight of stalk depended on the width of row; it was always greater in the wider rows, and less with rows closer together. The narrow rows always gave quite thin canes. No effect of the width of the rows on the richness of the cane could be observed.

The author recommends that the grower plant cane in rows as close together as will permit of mechanical cultivation under his conditions and with the type of machine he employs.

Paper mulching for cane, C. F. ECKART (*Facts About Sugar, 10* (*1920*), *No. 20, pp. 392, 393, figs. 3*).—The use of paper mulches on sugar cane at the Olaa plantation, Hawaii, is reported to have resulted in a large saving of labor and increased yields. The procedure consists of laying a strip of asphalt-saturated bagasse paper from 24 to 36 in. in width on the cane row, the young shoots penetrating the paper and emerging, while all the grasses and weeds are

smothered. To function properly, the paper should possess a dry-test bursting strength not exceeding 20 lbs. per square inch and 5 lbs. bursting strength after immersion in water for 10 minutes, and allow a stand of at least 100 shoots per 100 lineal feet at the end of the second week after placing.

The comparisons of mulched *v.* unmulched plats showed the labor requirements per acre for the first hoeing to be 2.26 men for cane treated with 36 in. mulch, and 3.54 men for 24 in. mulch as compared with 7.62 men with unmulched cane. This represented a saving of 53.5 per cent for the 24 in. paper and 70.3 per cent for the 36 in. paper. The second hoeing is said to have resulted in a saving of 20.2 per cent of labor with the 24 in. and 30 5 per cent with the 36 in. paper.

Plats mulched with 36 in. paper for the 1918 crop were harvested and left without further treatment for the 1920 crop. Although the mulch had disappeared, the residual effect was noticeable; the mulched plats showed savings of 22, 22, and 23 per cent of labor for the first, second, and third hoeings, respectively, as compared with plats not mulched for the 1918 crop. The saving of total hoeing labor has ranged from 30.2 per cent with 18 in. paper to 68.6 per cent with 36 in. paper.

The process is considered to be particularly advantageous for wet conditions where weed growth is vigorous, and its value as a plantation practice is primarily dependent upon the availability of labor for hoeing purposes. Paper mulching is not recommended for nonirrigated plantations with plentiful labor and few weeds.

The cultivation of sugar cane in Queensland, H. T. EASTERBY (*Queensland Bur. Sugar Expt. Stas. Bul. 3 (1920), pp. 45, figs. 14*).—Cultural methods and field practices employed in growing sugar cane in Queensland are discussed, together with notes on the climatic adaptation of the crop, insect pests, and diseases, and instructions on clearing land and mixing fertilizers. Analyses of the important commercial varieties grown in the State are tabulated and the principal sugar districts briefly described.

Sweet potato culture in Arkansas, C. WOOLSEY (*Ark. Agr. Col. Ext. Circ. 90 (1920), pp. 1–20, figs. 11*).—A discussion of field practices and cultural methods approved for growing sweet potatoes in Arkansas, together with information on harvesting, storing, and marketing the crop, and brief descriptions of the more important commercial varieties.

Experimental tobacco work in Pennsylvania, O. OLSON (*Tobacco, 70 (1920), No. 18, pp. 4, 5, 8, figs. 6*).—An article describing tobacco experiments conducted by the Pennsylvania Experiment Station in cooperation with the U. S. Department of Agriculture, and including improvement of yield and quality of Pennsylvania cigar tobacco, seed breeding, fertilizer and curing experiments, and adaptation and hybridization studies. These experiments have been previously noted (E. S. R., 38, p. 36; 43, p. 533).

Cuba's tobacco industry, H. O. NEVILLE (*Cuba Rev., 18 (1920), No. 10, pp. 16–31, figs. 17; also in Tobacco, 70 (1920), No. 26, pp. 10–14, figs. 17*).—The author outlines the varying characteristics of the tobaccos produced in the Vuelta Abajo, Semi Vuelta, and Vuelta Arriba sections of Cuba, describing the soils and detailing the methods employed in growing the crop and preparing the leaf for market.

The westward movement of the wheat-growing industry in the United States, L. B. SCHMIDT (*Iowa Jour. Hist. and Politics, 18 (1920), No. 3, pp. 396–412*).—This paper traces the westward trend of the wheat-growing industry from the colonial period until the first decade of the present century, and discusses the relative influence of the factors of increase of population, develop-

ment of transportation, governmental land policy, improvement of farm machinery, the growth of domestic markets, and expansion of foreign markets in hastening the rapid movement of the industry from the Atlantic Coast to the North Central region.

New wheat varieties (*Amer. Miller, 48 (1920), No. 11, pp. 1197, 1198*).—The article comprises a brief summary of the work of the State experiment stations in breeding and introducing new wheat strains.

Survey of our cultivated wheat varieties, D. TROOST (*Cultura, 32 (1920), No. 382–383, pp. 226–244*).—A chronological account of the origin of the native and introduced wheat varieties grown in the Netherlands.

A classification and detailed description of some of the wheats of Australia (*Aust. Inst. Sci. and Indus. Bul. 18 (1920), pp. 48, pls. 5*).—This bulletin presents a provisional scheme of classification and key to the Australian wheat varieties, defines the botanical and agricultural characters distinguishing the classes and types, and describes 46 of the more important commercial varieties of common and durum wheat grown in the Commonwealth.

Commercial agricultural seeds, 1920, C. D. WOODS (*Maine Sta. Off. Insp. 98 (1920), pp. 89–112*).—The results of examinations of samples of seed in 1920 are reported, together with a list of noxious weed seeds.

The New York seed law and seed testing, M. T. MUNN (*New York State Sta. Bul. 476 (1920), pp. 3–28, figs. 4; abridged ed., pp. 3–15*).—This publication outlines the main features of the New York seed law, effective July 1, 1920, requiring the labeling of agricultural seeds intended for sale within the State of New York for seeding purposes within the State. The law requires that each lot of seed carry a statement, tag, or label bearing the following information: The commonly accepted name of such seed; the approximate percentage, by weight, of purity; the percentage of weed seeds; the name of each kind of the seeds of noxious weeds; the percentage of germination, together with the month and year when the test was made; and the full name and address of the vendor. Slight modifications are required in the case of mixtures or special mixtures. Suitable forms for labeling the three distinct classes of seeds provided for in the law are illustrated.

The author discusses in some detail the various provisions of the law concerning exemptions, seed inspection, law enforcement, and duties of seed merchants, and includes the rules and methods of seed testing adopted by the State seed testing laboratory.

Principal noxious weeds of Kansas, H. F. ROBERTS (*Kansas Sta. Circ. 84 (1920), pp. 19, figs. 10*).—This circular describes the plant and manner of its dissemination, and indicates approved methods of eradication of the principal noxious perennial weeds of Kansas, including buckhorn, Johnson grass, bindweed, quack grass, and Canada thistle, and the principal noxious annual weeds, including dodder, Russian thistle, cheat, foxtail, and crab grass.

Report of Weeds Commission, S. A. BEDFORD, G. WALTON, and H. B. BROWN (*Manitoba Dept. Agr. and Immigr. Ann. Rpt., 1919, pp. 48–53, figs. 4; abs. in Agr. Gaz. Canada, 7 (1920), No. 2, pp. 142, 143*).—This comprises the fourth annual report of the Weeds Commmission of the Manitoba Department of Agriculture in the enforcement of the Noxious Weeds Act. The most successful method of combating Russian thistle was found to consist of double-disking or cultivating the grain stubble directly behind the binder and before the grain is shocked.

The spread of the puncture vine in California, E. JOHNSON (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 8, pp. 330–332, figs. 2*).—Puncture vine (*Tribulus terrestris*), probably introduced from the Mediterranean region, is reported

as a troublesome weed in the fertile valleys and along the railroads in California. The plant produces numerous prostrate stems frequently 8 ft. in length and usually bearing 5 burs at each joint. The burs possess two or more sharp spines which often pierce bicycle and automobile tires, besides inflicting severe injuries on all classes of live stock. Intensive farming practices will control the weed on cultivated lands, but more adequate measures are deemed necessary for waste land and along highways and railroads.

HORTICULTURE.

The calendar of garden operations (*London: Gardners' Chron., Ltd., 1920, rev. and enl., pp. [6]+174, figs. 38*).—A monthly calendar of garden operations, based on the original work compiled by Joseph Paxton in 1842 but revised and enlarged to include modern practices.

Analyses of materials sold as insecticides and fungicides during 1920, C. S. Cathcart and R. L. Willis (*New Jersey Stas. Bul. 343 (1920), pp 5 20*).—Results are given of analyses of Paris green, lead arsenate, calcium arsenate, Bordeaux mixture, lime-sulphur solution, soluble sulphur compounds, nicotin preparations, and miscellaneous materials sold in New Jersey during 1920.

Report of the horticulturist, C. A. McCue (*Delaware Sta. Bul. 125 (1919), pp. 19–24*)—In connection with long-continued study of varying fertilizer treatment on the growth of the peach, soil temperature data have been recorded in the form of graphs. A study of the graphs of semidaily soil temperatures in the concrete pits shows that there is apparently no correlation between soil temperature and fertilizer treatment.

A list is given of varieties of peaches recommended for commercial trial. Relative to plums, it is concluded that few of the European plums have any place in Delaware horticulture. They are slow in coming into bearing and subject to serious attacks of brown rot Of the Japanese plums, Wickson, Orient, Shiro, and Purple Flesh are promising for the light sandy soils of the southern part of the State. Sweet cherries continue to be disappointing. Of the sour cherries Montmorency strains are the most valuable. Quinces are a failure, owing to fire blight. Pears have likewise suffered seriously from blight.

The cover crop study with apple trees has been interrupted owing to heavy infections of hairy root and crown gall. The peach cover crop work was reported in bulletin form (E. S. R., 41, p. 444). Recent observations on this work show evidence of a correlation between the diameter of trunk increment and yield. In view of other influential factors, however, trunk increment is not considered a reliable index of peach tree performance

[Report on horticultural investigations at the Iowa Station] (*Iowa Sta. Rpt. 1919, pp. 31–33, 50–52*).—A progress report on various projects for the year, continuing previous work (E. S. R., 41, p. 237).

In efforts to secure a blight-resistant pear at the State fruit-breeding farm at Charles City through the use of *Pyrus ussuriensis*, over 1,200 seedlings are now growing which show marked hardiness and resistance to blight. It is stated that during the year one of these crosses produced fruit which perhaps will be as good in quality as Bartlett or Anjou.

In the orchard stocks investigation, a way to secure perfect rooting from the scion has been found. This is accomplished by girdling the union of the scion and seedling root with a piece of copper wire. When the graft is planted in the spring, the seedling root starts growth and furnishes the scion sufficient food to start its growth. As soon as the copper wire begins to cut through the

outer bark and into the cambium layer the plant food returning from the leaves is prevented from going down to the root. The accumulation of carbohydrates at the girdle induces root production, and consequently the scion soon establishes itself on a root system of its own. The discovery is considered of value in other investigations with tree fruits.

In the soil management experiments at Council Bluffs, yields per acre for the period 1911–1919 have averaged for Northwest Greenings as follows: Clover sod, 410 bu.; clover crop, 405; clean cultivation, 380; and blue grass sod, 230 bu. With Grimes the corresponding yields were 360, 300, 290, and 200 bu. per acre.

Tests of horticultural crops [on the Newlands, Nev., Experiment Farm in 1919], F. B. HEADLEY (*U. S. Dept. Agr., Dept. Circ. 136* (*1920*), *pp. 13–16*).—Continuing previous work (E. S. R., 43, p. 437), an experiment was conducted to determine the value of acid phosphate as a fertilizer for tomatoes. The data given are inconclusive owing to the serious loss of plants by Fusarium blight. No evidence has been secured thus far indicating any relationship between the addition of the phosphate and the loss of the plants by blight. Data are given on a variety test of sweet corn, and a record is also given of the blossoming dates for the four years 1916–1919 of fruit varieties in the farm orchard. Lists are given of varieties of fruits recommended for planting on the Newlands project.

Report of the horticulturist, T. B. MCCLELLAND (*Porto Rico Sta. Rpt. 1919*, *pp. 16–21*, *pls. 3*).—Investigations in 1919 were continued along lines previously noted (E. S. R., 44, p. 235).

Of 14 seedlings from grafted Cambodiana mangoes that fruited during the past two seasons, 7 came true to the parent type. Among those which differ from the parent type are found some variations which prove objectionable; other variations may not be so considered. It is again concluded that the chances for securing good seedling varieties from Cambodiana are good enough to warrant planting the seed. The Itamarca mango continues to show itself a very prolific late variety. Notes are given on the Brindabani variety, which fruited for the first time at the station in 1919. The fruit is only of fair quality, and the major part of the crop was diseased, apparently with anthracnose. Experimental shipments to the States of mangoes packed in boxes filled with ground cork and without refrigeration were unsuccessful. Approximately two-thirds of the fruit was found rotting on its receipt, 10 days after picking With mangoes wrapped in orange papers, packed in a well ventilated crate, and refrigerated on the boat, there was a decay of only 8 per cent 10 days after shipment.

Among recent results in the vanilla investigation it was found that where but 2 pods per cluster were allowed to develop the vine made sufficient new growth for the production of a greater number of pods the following season. This was not the case where 4 and 6 pods per cluster were allowed to develop. The same relative sequence as for the preceding crop was maintained as to the weight of the average production per vine and of the average pod; the greater the number of pods per cluster the lower was the weight per pod, but the higher the weight of total production. Observations made on the appearance of the vanilla pod just prior to splitting show that the pods have an oily appearance on the average about a month before splitting, although this time was reduced to a few days in some cases. The oiliness extends from about one-third of the pod's length to nearly the whole. As maturity is approached the pod assumes a mellow appearance, as though the oil had soaked in. A preliminary experiment indicates that curing should take place promptly after picking. Studies of different methods of curing are being continued.

The results with aerial vanilla cuttings confirm those previously noted. The development of roots is much more rapid if the lower part of the cutting is covered with leaf mulch. Nine cuttings that had been suspended for over a year had slowly made long aerial roots in their effort to reach the ground. When these cuttings were placed on the ground and the lower portion of each covered with damp leaves new active root growth started in a few weeks' time.

At a little more than four years after date of planting the seed of Robusta coffee, which is now so largely grown in Java, it was found that about 60 per cent of the most favorably located trees were in production. This crop averaged nearly 2 liters of coffee cherries per fruiting tree. Of several leguminous trees now being tested as shade trees for coffee plantations, *Gliricidia maculata* is proving to be so satisfactory that it is being distributed to coffee growers.

Individual records on the yields of cacao trees are being continued. In the youngest plantation a little less than half of the trees fruited at five years from seed and averaged a little less than 6 pods per tree.

Varietal and cultural tests of vegetables were continued during the year. The Lady Washington and Navy beans, which were not tested the previous season, ranked with, or surpassed, some varieties grown locally. They did not, however, equal in yield the Porto Rican white bean, which was exceeded only by the black Venezuelan bean. Among the plants of the latter, which is of very late maturing habit, an early maturing strain has been found and is being propagated for testing. Varieties of locally grown and imported Lima beans were planted, some of which, when analyzed by the Food and Drug Inspection Laboratory of the Bureau of Chemistry, U. S. Department of Agriculture, were shown to be rankly poisonous. Several varieties of tomatoes were tested, and Mack Prolific (F. H. B. 23572) proved of excellent quality.

Among the ornamentals being tested at the station a plant of *Thumbergia erecta cærulea* has developed a sporting branch in whose flowers the rich purple of this variety is replaced by lavendar. The name *lilacina* is suggested for this variety. It is being propagated for distribution.

[Report on vegetable and fruit breeding], W. P. Snyder (*Porto Rico Sta. Rpt. 1919, pp. 25–28*).—Plant breeding work was resumed on December 30. 1918, with the return of the author from military service.

A cross has been made between the Greater Baltimore and native tomato with the view of securing a large fruited tomato having the vigor of the native variety. Crosses have also been made between introduced kinds of muskmelons and a large, very vigorous, native variety. Data are given on cultural tests of several tomato and melon varieties. A trial of a cross between the native white and Early Adams corn gave an average of three ears with a total weight of 13 oz. per hill of two stalks. This yield was inferior to that of the native corn, but better than the yield of sweet corn varieties from the States. Thus far, white Cariaco corn from Venezuela has given the best results as a table corn.

Work with grapefruit included bud selection with the view of securing desirable strains and crossing between the Duncan and Triumph varieties. About 100 reciprocal crosses were made. Selections of the Chamaluco banana were made with the view of securing wilt-resistant strains. Some of these selections after exposure in a disease-infested field remained vigorous and healthy and will be further tested.

Artificial maturation of fruits, C.-L. Gatin (*Jour. Agr. Trop., 19 (1919), No. 159, pp. 256–260*).—An incomplete posthumous paper prepared by the author in 1914 is here presented. It briefly reviews Gerber's study of chemical changes

during the ripening of fruits (E. S. R., 9, p. 1025) and the work of more recent American investigators in ripening dates and persimmons.

Alexander Lucas, a variety of pear successfully introduced into Sweden, G. Lind (*K. Landtbr. Akad. Handl. och. Tidskr., 58 (1919), No. 2, pp. 57, 58; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 10 (1919), No. 7–9, p. 910*).—This variety, introduced from Germany into Scania, Sweden, in 1911, has proved a satisfactory late-keeping pear. Under ordinary cellar conditions the pears keep in good condition up to Christmas, and in cold storage they keep well through February of the following year.

Muscadine grapes: Culture and varieties, W. J. Young (*South Carolina Bul. 205 (1920), pp. 48, figs. 19*).—This bulletin, based in part on Bulletin 132 (E. S. R., 19, p. 740), discusses the botanical characters and classification of *Vitis rotundifolia* and *V. munsonia* grapes, their climatic and soil requirements and distribution, planting, cultivation and fertilization, pruning and training, harvesting and handling the crop, pollination, the production of improved varieties, propagation, and diseases and insects. Detailed descriptions are given of the Eden, Flowers, James, La Salle, Memory, Mish, San Jacinto, Scuppernong, and Thomas varieties, with brief notes of 16 other varieties.

FORESTRY.

Care and improvement of the farm woods, C. R. Tillotson (*U. S. Dept. Agr., Farmers' Bul. 1177 (1920), pp. 27, figs. 7*).—This discusses the types of farm woods, the essentials of a good woodlot, improvement cuttings of various kinds, pasturing of farm woods, fire protection, insects and fungi, care in logging, and methods of regeneration.

The forest flora of the globe, L. Chancerel (*Flore Forestière du Globe. Paris: Gauthier-Villars & Co., 1920, pp. [4]+738*).—A practical treatise on the principal forest trees of the world with reference to their botanical and forest characteristics, geographic distribution, habitat, soil adaptations, species and varieties, the constitution and properties of their woods, various products, silvicultural uses, and diseases and other enemies.

The vegetative propagation of Hevea brasiliensis, J. G. J. A. Maas (*Arch. Rubbercult. Nederland. Indië, 3 (1919), No. 7, pp. 279–287, pls. 8, fig. 1*).—A summary in English of a lecture delivered in Medan discussing the vegetative propagation of Hevea from a theoretical point of view, describing different methods applied in the vegetative propagation of Hevea, and giving the results of some experimental propagation tests.

The biology of the flower of Hevea brasiliensis, J. G. J. A. Maas (*Arch. Rubbercult. Nederland. Indië, 3 (1919), No. 7, pp. 288–312, pls. 5*).—A study, with a summary in English, of the floral biology of Hevea trees conducted with the view of determining whether individual trees are self-fertile or self-sterile.

The pollination experiments made indicate that self-fertilization does take place in certain trees, but that cross-fertilization is the rule. Even with cross-fertilization certain trees give few or no seeds; hence the desirability of starting a seed garden with budded trees from a good mother tree.

Investigations regarding the formation of latex in Hevea brasiliensis, W. Bobilioff, jr. (*Arch. Rubbercult. Nederland. Indië, 3 (1919), No. 8, pp. 374–407, figs. 2*).—In continuation of a previous paper dealing with the origin of latex vessels and latex (E. S. R., 42, p. 144.), the present paper gives special attention to the manner in which latex develops as it is drawn from the tree. The paper is summarized in English.

The reaction of the latex of Hevea brasiliensis, W. Bobilioff, sr. (*Arch. Rubbercult. Nederland. Indië, 3 (1919), No. 8, pp. 408–411*).—A paper with English summary giving the results of analyses of fresh latexes from many trees of various ages. Contrary to the general opinion that the latex of Hevea has an alkaline reaction, the author found that the latex generally showed an acid reaction, with a neutral reaction in a few cases.

DISEASES OF PLANTS.

[Report of the plant pathologist], T. F. Manns (*Delaware Sta. Bul. 125 (1919), pp. 25–28*).—In a study of sweet potato diseases carried on in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, particular attention was paid to soil pox, which is said to be a typical soil disease. When once the land has become sick, it is difficult to remedy the trouble. Applications of manure, lime, phosphorus, and combinations of these have been used with very little or no beneficial results so far as decreasing the disease is concerned.

Continued attention is being given to the diseases of the peach and their control, and following up previous work (E. S. R., 41, p. 157) the author reports injury to peach trees from the use of a tree protector fastened to the trunk with wax. Quite a number of experimental trees died at the end of the second summer, and others showed the bark injured about a portion of the collar. The injury to the trees from this source is said to complicate somewhat the results of the inoculation experiments with yellows and little peach, since symptoms produced by the injury greatly resemble those of these diseases. Inoculations thus far with little peach material have given no infection. The author reports considerable losses during the last two seasons from blossom blight, which is due to the same fungus which causes brown rot. The disease is said to be difficult to control by spraying, since the organism enters the blossom through the pistil.

A brief description is given of a collar root rot of apples which the author states is caused by the blight organism (*Bacillus amylovorus*). Sun scald is associated with the collar rot, since the organism is washed down the tree trunk and gains access in the openings caused by winter injury, resulting in a rapid collar rot. Since this disease is directly due to sun scald, hilling up about the trees is recommended, not only to prevent injury from sun scald but also the bacterial collar rot.

[Report of the division of botany, Iowa Station] (*Iowa Sta. Rpt. 1919, pp. 22–25*).—Summary accounts are given of investigations conducted in the department of botany, the principal ones being investigations of diseases of corn, oat rust, relation of barberry to stem rust, cabbage yellows, potato diseases in relation to seed and crop production, and bacteria in crown gall of apple. Detailed accounts of some of these investigations have been noted elsewhere (E. S. R., 41, pp. 49, 245; 43, p. 653).

In the investigation of corn diseases more than 500 ears of field and a like number of ears of sweet corn were submitted to the germinator test. Fusarium and other molds were frequently found associated with the discoloration of grain, but not in all cases. The grain was planted and observations made for disease symptoms, which will be reported later. It is stated that corn was extensively affected by a disease producing purple blotches and spots on the leaf sheaths, and examination showed that within the leaf sheaths at these points there were large numbers of dead pollen grains and pollen sacs. These act as media for saprophytic organisms, which later enter the sheath tissues.

The injury does not ordinarily develop until the host has begun to mature, and consequently it has little effect in reducing the yield.

Department of botany, A. V. Osmun (*Massachusetts Sta. Rpt. 1919, pt. 1, pp. 13a–17a*).—Progress reports are given on various projects and plant diseases under investigation, including lettuce drop caused by *Sclerotinia libertiana*, spraying experiments with celery, onion diseases, particularly smut caused by *Urocystis cepulæ*, the optimum light requirements of plants, and weather conditions in relation to the development of plant diseases.

Attention has also been given to the dying back of shrubs and trees during the summer, and as a result it is believed that the trouble can be traced to moderate injury from the severe winter conditions of 1917–18. Apparently the balance between roots and top was destroyed, resulting in the dying back of twigs and branches during 1919. Efforts were made to follow up evidence in regard to parasitism of Phoma on potatoes, but no cases of disease caused by this fungus were found and attempts to produce it by artificial inoculation were only partially successful.

Miscellaneous notes are given on a number of plant diseases observed during the year.

Report of the imperial mycologist, F. J. F. Shaw (*Agr. Research Inst. Pusa Sci. Rpts., 1917–18, pp. 71–83*).—This information is on the same general plan as the report for the previous year (E. S. R., 39, p. 146).

Rice ufra (*Tylenchus angustus*) can sometimes be conveyed by seed from an infested crop. Moisture, temperature, and starvation are influencing factors in the movements of nematodes.

Black band disease of jute (*Corchorus capsularis*) proves to be due to *Diplodia corchori*, not hitherto suspected of being more than an occasional parasite, though known as such since 1910. Root rot of sal trees was not definitely referred to *Polyporus shoreæ*. Black thread disease of rubber has invaded nearly every plantation in Burma.

Chili die-back (*Vermicularia capsici*) was controlled by two sprayings with Burgundy mixture, one soon after the flowers set, the other two weeks later. Chili anthracnose has been studied. *Glœosporium piperatum* and *Colletotrichum nigrum* proved to be identical, the conidial forms of *Glomerella cingulata* (*G. piperata*). A chili blossom and twig rot has been identified as *Choanephora cucurbitarum*, not previously known to exist in India.

Fruit diseases include apple root rot (*Rosellinia* sp.), apple cracking and branch blister (*Coniothecium chomatosporum*), fire blight (bacterial), papaya foot rot (*Pythium* sp.), and peach ripe rot (*Aspergillus* sp.).

Peanut is attacked by true tikka (*Cercospora personata*) and a closely similar disease due to a Cercospora of undetermined species. Other diseases mentioned include tobacco damping off (*Pythium gracile*), Rangoon bean disease, formerly attributed (erroneously) to *Phytophthora* sp., an opium poppy mildew (*Erysiphe polygoni*), sugar cane "djamoer oepas" (a sclerotial fungus, also infecting paddy), rahar (*Cajanus indicus*) wilt disease and tobacco tokra.

Report of the imperial mycologist, E. J. Butler (*Agr. Research Inst. Pusa Sci. Rpts., 1918–19, pp. 68–85*).—Besides the subjects usually reported in these communications (see above), this includes a brief account of the second conference of mycological workers in India.

Black band disease of jute was further studied. The late sown crop appears to be relatively immune to the fungus (*Diplodia corchori*).

Apple and cherry rot continued to cause loss, but apple cracking and branch blister (*Coniothecium chomatosporum*) was not so severe as formerly. Apple mildew (*Podosphæra* sp.), probably the most widespread of the fungus dis-

eases of apple in Kumaon, extends rapidly during the month just previous to the break of the monsoon. Apple fly speck and sooty blotch (*Leptothyrium pomi*) was decreased by use of lime-sulphur spray. Striking differences were noted in the susceptibility of different apple varieties to disease, and to spray injury. Peach leaf curl (*Exoascus deformans*), which had been serious in 1918, was treated in 1919 with lime-sulphur, Burgundy mixture, and Berger's lime-sulphur, all proving to be efficacious, while one tree overlooked in spraying became covered with leaf curl.

Chili die back (*Vermicularia capsici*) treatment gave no definite results. Rahar (*Cajanus indicus*) as a shading intercrop had a stunting effect. Chili blossom and twig rot (*Choanephora cucurbitarum*) was not observed during the year, this fact in connection with its prevalence during the previous year suggesting the importance of humidity to the development of this disease. A new chili disease of unknown causation caused some loss. The trouble starts at the base of the forked branches, traveling upward and downward as a dull discoloration, the bark later becoming chalky-white. The injury is usually confined to parts facing south. The plants show a leaf cast from the upper part and a gradual die-back.

A disease of tobacco and papaya yielded the fungus *Pythium debaryanum*. A disease of ginger has been referred to a new species reported by Subramaniam, *P. butleri*. Sugar cane smut (*Ustilago sacchari*) occurs only through tender and young eyes or injured older eyes, the hyphæ entering the eyes by way of the scale hairs but not penetrating directly the epidermis. The disease of Rangoon bean formerly supposed to be due to Phytophthora is now thought to be caused by *Botrytis* sp.

Rotting of stored potatoes is a serious problem in several parts of India. The trouble appears to be connected with high temperature of the tubers at the time of storing.

Wheat rusts (*Puccinia triticina* and *P. graminis*) were present, while *P. glumarum* was absent. Practically every cultivated cereal grown near Pusa is attacked by one or more species of Helminthosporium.

Two diseases of sugar cane from the Central Provinces appear to be identical with diseases known as sour rot and red rot in Java, the latter form also occurring on jute (*Corchorus olitorius*).

Field experiments with tokra (Orobanche) on tobacco raised from seed obtained from Peshawar showed no higher immunity than did ordinary tobacco.

Comparative studies on *Phytophthora* sp. show *P. terrestria* to agree with *P. parasitica*. This species and another are said to have been found to attack coconuts in Jamaica, and the latter is said to cause coconut bud rot in the West Indies. Cultures of this fungus are said to prove its identity with *Phytophthora palmivora* (*Pythium palmivorum*). Work on the Phytophthora found on rubber has strengthened the view that all the forms hitherto found on this host in India and Burma belong to the one species.

The brown spot of corn with suggestions for its control, W. H. TISDALE (*U. S. Dept. Agr., Farmers' Bul. 1124* (*1920*), *pp. 9, figs. 4*).—A popular description is given of the brown spot of corn due to *Physoderma zeæ maydis*. This disease is characterized by the appearance of brown spots on the leaf, leaf sheath, and stalk, and in rare cases on the outer husks of the ears. The disease is said to be serious, appearing abundantly throughout the southeastern part of the United States. High temperature with moist atmosphere favors the development of the disease, and if these conditions occur before the corn plants are more than half grown the disease may do considerable damage.

For the control of this trouble the author recommends the cutting and plowing under of cornstalks, crop rotation, and the obtaining of seed corn from ears

picked from disease-free plants or plants as nearly free from disease as possible.

Wheat yellow rust outbreaks, 1914 and 1916, H. C. MÜLLER and E. MOLZ (*Fühling's Landw. Ztg., 66 (1917), No. 2, pp. 42–55*).—As regards the incidence and control of wheat yellow rust (*Puccinia glumarum*), the author concludes that susceptibility of winter wheat results from arrest of growth. This was due in 1914 and 1916 to soil dryness and cold nights. Favoring conditions included also temperatures favorable to the germination of the Uredospores. The influence of nitrogenous fertilizers was not made clear. Phosphorus and potassium fertilizers heightened resistance.

Uniform rules and regulations for seed potato certification in the Pacific Coast States, M. B. MCKAY (*Calif. Comn. Hort. Mo. Bul., 8 (1919), No. 6, pp. 288–291*).—This includes a discussion of insect pests and diseases of potatoes and laws relating thereto, also regarding diseases of unknown causation.

Discussion of potato seed certification service, M. F. BARRUS (*Calif. Comn. Hort. Mo. Bul., 8 (1919), No. 6, pp. 278–280*).—This is a discussion of the meaning of good potato seed, its production, the organization of seed certification service, inspection at the point of shipment, and the improvement of seed stock.

Uniformity of rules and regulations of potato seed certification, E. P. TAYLOR (*Calif. Comn. Hort. Mo. Bul., 8 (1919), No. 6, pp. 280–285*).—This includes a review of potato seed certification work, desirable varieties, standards, disqualifying points, regulations, inspections, and certifications.

Reversion and resistance of potato varieties to canker, O. APPEL (*Arb. Gesell. Förd. Baues u. Verwend. Kartoffeln, No. 15 (1918), pp. 19, pl. 1*).—Discussion of the behavior of certain potato varieties as regards resistance to canker, and of the inheritance of this property, is given in connection with lists of varieties said to be immune to potato canker or susceptible thereto in various degrees.

The cultivation, composition, and diseases of the potato (*Jour. Bd. Agr. [London], Sup. 18 (1919), pp. 115, pls. 23, figs. 2*).—This supplement deals with the cultivation of potatoes, also with potato diseases, including the effects of spraying.

Potato disceses, A. D. Cotton (pp. 28–48).—This article purports to give a brief account of all the recognized potato diseases occurring in Britain, including late blight (*Phytophthora infestans*), wart disease (*Synchytrium endobioticum*), corky or powdry scab (*Spongospora subterranea*), blackleg or black stem rot (*Bacillus atrosepticus*), leaf curl (undetermined causation), dry rot (*Fusarium cœruleum*), scab (*Actinomyces* sp.), stalk disease (*Sclerotinia sclerotiorum*), Botrytis disease (*B. cinerea*), black speck scab or collar fungus (*Corticium solani*), violet root rot (*Rhizoctonia violacea*), pink rot (*P. erythroseptica*), Verticillium disease (*V. alboatrum*), sprain and internal rust spot (undetermined), skin spot (probably not *Spicaria solani*), silver scurf (*Spondylocladium atrovirens*) and "rust" (undetermined).

The causes of decay in potato clamps, with special reference to the season 1918, A. D. Cotton and H. V. Taylor (pp. 48–60).—This paper, reporting in considerable detail the results of a preliminary inspection, deals with the forms and causes of decay in potato clamps (storage mounds), including blight (*Phytophthora infestans*), freezing and flooding, blackleg (*Bacillus atrosepticus*), wet rot favored by heating, Fusarium rot (*F. cœruleum*), and frost; with causes of heating, as respiration (normal or due to injury, unripeness, or sprouting), or the heating activities of microorganisms; and with conditions favoring the production of heat, as moisture and lack of ventilation.

Practical suggestions offered include control of conditions at storing time (maturity, dryness, and freedom from soil, unsound or diseased tubers or tubers which have been flooded or frozen), and limitation of the size of enclosures, which should occupy a site that is dry and well drained.

Practical hints on potato spraying (pp. 60–63).—The results of spraying experiments during a term of years are submitted, with suggestions regarding the care and use of spraying machines, instructions for making Burgundy and Bordeaux mixtures, and suggestions regarding measures designed to prevent or check the spread of potato diseases.

Report of the potato spraying trials, 1918, F. T. Brooks (pp. 63–68).—Arrangements were initiated to carry out on as uniform a plan as possible spraying experiments for the control of potato blight in different parts of the country in 1918. The trials were conducted in four series, differing as to scale and purpose, as indicated.

In most cases the average gain from spraying was about 1.5 tons per acre. Spray injury, occurring in several instances, was not in all cases explainable as to the exact mode of its production.

In smoky districts Bordeaux apparently caused somewhat less scorching than did Burgundy mixture. The later sprayings were the more effective, three applications, therefore, being better than two, and one late spraying often being more effective than the two earlier sprays. Except perhaps in very wet districts, the 1 per cent spray was as effective as the 2 per cent mixture. The three sprayings at 1 per cent are regarded as better than two at 2 per cent.

Burgundy mixtures containing 6 to 7 lbs. sodium carbonate instead of 5 lbs. per 40 gal., while usually harmless, apparently reduced scorching in smoky districts.

Dry sprays, though not so effective as wet applications, are better than none. They should be applied while the dew is still on the leaves.

Soda ash and similar substances (which are practically washing soda without the water of crystallization) were used with success in making Burgundy mixture. The incorporation of various adhesives, as soft soap, soap powder, and glue, with the spraying mixture was not very advantageous.

Proprietary fungicides, tried on a limited scale, showed a great range in difference of effectiveness.

Less scorching of haulms due to sprays is attributed to greater care in mixing and less aphid injury than in former years. Most cases of scorching occurred in the vicinity of towns supposedly polluting the atmosphere. Other factors discussed as influencing blight are variety, soil, situation, and time of digging, especially during a wet fall season.

Ormskirk potato [wart disease immunity] trials, 1918, J. Snell (pp. 68–102).—The primary object of these trials was to test potato varieties for immunity to wart disease. A detailed account is given of the operations and their results, with lists of varieties susceptible (in various degrees), immune, doubtful, or previously immune, with a descriptive and classified list of immune varieties as early, second early, or late. A discussion is also given of the difficulties and confusion introduced by the existence of synonyms. Disastrous effects are shown to result from planting susceptible varieties.

Potatoes: Local immune variety trials, 1918, *J. Snell* (pp. 103–114).—In order to obtain reliable information regarding the immunity to wart disease of potato varieties for districts other than that covered in the Ormskirk trials above noted, tests were carried out in those parts of the country where wart disease had become a serious menace to the potato crop. Thirty-six districts were selected, and the tests were made on both a large and a small scale.

From the tabulation and discussion of conditions and results, it appears that among the immune varieties are some of the heaviest bearers in cultivation at the present time. Tests of cooking qualities were also reported from several centers.

Decay in potato clamps due to blackleg, S. G. PAINE and C. M. HAENSELER (*Jour. Min. Agr. [London], 27 (1920), No. 1, pp. 78–80*).—A description is given of a form of soft rot, discovered at two farms near Spaulding, Lincolnshire, associated with a mixed bacterial population (*Bacillus mesentericus, B. subtilis*, and *B. mycoides* predominating), but attributed (on completion of inoculation tests) to the activity of *B. atrosepticus*, which is considered to be the organism causing blackleg. It is not known whether this organism initiated the trouble in the present case, though it was more common in the fields than during the previous summer. A discussion is given regarding the proper construction and ventilation of the clamps (storage mounds).

Potato mosaic, D. FOLSOM (*Maine Sta. Bul. 292 (1920), pp. 157–184, pls. 2*).—This bulletin is based on investigations conducted cooperatively between the station and the Bureau of Plant Industry, U. S. Department of Agriculture. The principal results have already been noted (E. S. R., 42, p. 47; 43, p. 546).

The composition of potatoes immune from wart disease, E. J. RUSSELL (*Jour. Min. Agr. [London], 27 (1920), No. 1, pp. 49–51*).—Studies in which only a general comparison was possible are said to indicate that the percentage of dry matter and of nitrogen in varieties immune to wart disease is at least as high as in nonimmune varieties, so that the immune varieties may be substituted without loss in this particular. The data are not considered sufficient to warrant comparisons among the immune varieties.

Treatment of eelworm-infected seed, F. B. HEADLEY (*U. S. Dept. Agr., Dept. Circ. 136 (1920), pp. 12, 13*).—An account is given of experiments with nematode-infected potatoes used for seed. The potatoes were treated by heat for varying lengths of time and at different temperatures, after which the tubers were planted. The plantings were made in duplicate, and noninfected potatoes were planted every third row.

It appears from the results tabulated that treatments of 30° C. (86° F.) for 24 hours and possibly of 35° for 12 hours were beneficial and resulted in a better stand and higher yield. In general, prolonging the heat treatment or increasing the temperature to more than 40° had the effect of reducing the yield.

Attention is called to the fact that there was a light infection in the check rows planted with noninfected tubers. It is not known whether this infection resulted from eelworms originally in the soil, or in the seed used, or from migrations of eelworms from the rows adjoining where infected seed had been used.

Preliminary investigations on a bacterial disease of tobacco, G. P. DARNELL-SMITH (*Roy. Soc. N. S. Wales Jour. and Proc., 52 (1918), pp. 435–453, pl. 1*).—A brief account of the results of attack on tobacco seedlings by *Peronospora hyoscyami* is followed by a discussion of an outbreak (supposedly favored by such attack) on seedlings of a bacterial disease attributed to *Bacillus solanacearum*. Indications are noted that cultural differences obtained with different strains of *B. solanacearum* arise through differences of age or treatment of the cultures.

Blister canker and crown gall projects (*Iowa Sta. Rpt. 1919, pp. 33–35*).—Accounts are given of plant disease projects conducted under the pomology section of the station. It is considered that blister canker attacks principally trees which have been devitalized either by winter injury or by overbearing during periods of drought. On other trees which are hardy the cankers can

be controlled by removing the infected portion and by painting the wound with lead paint to which corrosive sublimate has been added.

A summary is given of the work on crown gall, a preliminary account of which has already been noted (E. S. R., 41, p. 348).

Circumventing the pear blight, W. L. HOWARD (*Calif. Dept. Agr. Mo. Bul., 8 (1919), No. 10, pp. 603, 604*).—In connection with the proposal to grow Bartlett pears, which are very susceptible to blight, on Surprise stock, which has proved to be perfectly immune, it is stated that the only Surprise tree of bearing age known to exist is located on the grounds of the Missouri Experiment Station. It is not yet known whether seedlings from this tree will be immune to blight.

Utilization of Surprise scions on comparatively resistant Japanese pear roots is discussed. It is thought that the use of a long scion on a short root will cause the former to give out roots of its own sufficiently vigorous to permit the removal of the Japanese roots, or that these may be retained for a time without production of sprouts if planted rather deeply in the soil. After the desired shape has been secured the main branches may then be grafted to Bartlett. This arrangement, though it confers no immunity on the Bartlett branches, will make it impossible for the blight to kill any portion of the tree below their union.

Cranberry disease investigations in New Jersey during 1918, R. B. WILCOX (*Amer. Cranberry Growers' Assoc. Proc. Ann. Conv., 49 (1919), pp. 15-21, fig. 1*).—Owing to weather conditions during the early period of high susceptibility, the proportion of cranberry rot was abnormally small during the year.

Fertilizer tests indicated that nitrogenous constituents tend to produce a luxuriance and tenderness favorable to disease and unfavorable to its control. These and other observations referred to evidenced the necessity for the regulation of growth and for ventilation.

Experimentation on a small scale regarding the effects of gathering berries and storing them while wet with dew showed that berries scooped and stored when wet undergo much more rot than do those picked dry or picked and dried before storing.

In spraying experiments, definite results were obtained in reduction of blast and control of scald or early rot when applications were made of Bordeaux mixture, one at the beginning of the flowering period, one at its close, and one two weeks later. The principal infection occurred during the rainy period of July 30 and 31, about two weeks after the period of blooming, the disease appearing on the fruit September 16. A second but lighter infection occurred following the rain of August 12. The greatest reduction was secured by spraying on the days preceding these two rains, the application of July 29 being the most effective of the season.

Indications are noted that bitter rot, or anthracnose, can attack berries of fairly large size, provided wet weather of a certain duration occurs. Dew is not sufficiently lasting to condition the disease. Spraying should be done immediately before a period of precipitation if practicable.

Citrus canker eradication in Florida, W. NEWELL (*Calif. Comn. Hort. Mo. Bul., 8 (1919), No. 7, pp. 394-399*).—An account is given with discussion of the early history of citrus canker and of attempts at complete control of the disease. These have now progressed so far as to show that a dangerous plant disease can be practically eradicated.

Observations on citrus scab, W. V. TOWER (*Porto Rico Sta. Rpt. 1919, pp. 22, 23*).—Attention is called to citrus scab and the possible relation of cultivation, use of nitrogenous fertilizers, types of soil, etc., to the prevalence of the disease.

Further investigations on the eelworm disease of Narcissus, J. K. RAMSBOTTOM (*Gard. Chron., 3. ser., 67 (1920), Nos. 1739, pp. 206, 207, figs. 4; 1740, p. 218, figs. 4*).—This is a lecture constituting the author's account of investigational work following up that previously reported (E. S. R., 43, p. 49) regarding eelworm disease of Narcissus and its ravages, with resulting loss.

Bulbs affected with nematodes may show merely an occasional spot, twisted foliage, or complete absence of foliage. Stunted or late flowers may or may not be due to nematodes.

A discussion is given of remedial measures. Soaking bulbs in cold solutions of chemicals for one to four days produced no effect, as the solution did not penetrate the bulb. Bulbs kept in water at 100° F. were sterilized completely in four hours, nearly so in two hours. The apparatus described for treating bulbs with hot water is operated on the principle of circulating water from a boiler to a supply tank, then through two soaking tanks, and then back to the boiler. It will take 800 lbs. of bulbs at a time. Injury appearing in flowers due to the treatment occurred only in case of the less mature bulbs. The hot water system is said to be an easy and effectual method for freeing Narcissus bulbs from eelworm, but the precautions given must be rigorously observed, especially as regards correct and even temperature throughout the vessel. For this reason it may be necessary to employ a special apparatus. No effective commercial sterilizer is known.

Oak fungus disease, oak root fungus disease, fungus root rot, toadstool root rot, or mushroom root rot, W. T. HORNE (*Calif. Comn. Hort. Mo. Bul., 8 (1919), No. 2, pp. 64-68, figs. 4*).—*Armillaria mellea*, more recently called *A. putrida*, is said to be one of the most widespread and injurious fungi in the Pacific coast region, as it infects various kinds of roots or wood lying in the soil, and may follow these within reach of living trees and shrubs and cause their death. In orchards the fungus usually develops from a center, spreading outward to cover extensive areas and killing even the replanted trees. Any of many species of trees and shrubs may be attacked. Suggestions and advice are offered.

A brief report of the proceedings and recommendations of the international white pine blister rust conference held in Portland, Oregon, April 23, 24, 1919, under the auspices of the Advisory Board of American Plant Pathologists, E. P. MEINECKE (*Calif. Dept. Agr. Mo. Bul., 8 (1919), No. 8, pp. 445-448*).—The recommendations of this conference, as embodied in 10 resolutions, are here given in full.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Observations on the habits of birds at Lake Burford, N. Mex., A. WETMORE (*Auk, 37 (1920), Nos. 2, pp. 221-247, pls. 3; 3, pp. 393-412*).

Keys to the orders of insects, F. BALFOUR-BROWNE (*Cambridge: Univ. Press, 1920, pp. VII+58, figs. 13*).—A key is given to the orders of insects, followed by keys to the families of Orthoptera, Rhynchota, Lepidoptera, Coleoptera, Diptera, and Hymenoptera.

[Economic insects and their control in Illinois], W. P. FLINT (*Ill. Dept. Registr. and Ed., Div. Nat. Hist. Survey, Ent. Ser. Circs. [1] (1918), pp. 6; [2]; 3 (1919), pp. 11, figs. 7; 4, pp. 7, figs. 2; 5, pp. 9, figs. 4*).—These circulars deal with (1) the more important insecticides and repellents, (2) chinch bug control, (3) methods of destroying grasshoppers, (4) the corn root aphis, and (5) chinch-bug barriers.

Entomology (*Iowa Sta. Rpt. 1919, pp. 27–30*).—In observations of the potato leafhopper it was found that there are only two generations a year, the first occurring on the early potatoes and the second on the late potatoes. In 1919 they suddenly appeared on June 6 in large numbers on the potatoes and infested all fields that were in full leaf at that time, where they remained until the second generation in July took flight and spread to the late potato field as suddenly and thoroughly as in the case of the spring migration. In no case was burning found except where leafhoppers were present, and the burning was always in proportion to the number of leafhoppers. It was found that a few larvæ introduced into a cage would produce the burning.

Work with onion thrips, extending over a period of three years, was completed. The most important points determined were that the thrips are largely distributed from greenhouses and sheltered situations where they overwinter, and that they spread in ever-widening circles day by day from these centers until the whole area is infested. The most feasible means of control appears to be in cleaning up greenhouses and storage houses and eliminating piles of screenings and refuse onions so that they will not afford hibernating places.

Investigations have shown that there is present in practically every cornfield in the State a species of borer that is quite similar to the European corn borer. This is a native species that bores in smartweed and wild lettuce, and the second generation, when these host plants dry up or are destroyed, readily transfers to corn. It does not, however, occur in sufficient numbers to be injurious, and apparently does not multiply in the corn. It passes the winter as a spotted caterpillar, boring in the pith of the weeds and cornstalks, and appears to have two generations annually.

Outbreaks during the year of the spring cankerworm, the army worm, and the variegated cutworm are noted.

There was a large increase in the amount of honey produced during the season, overwintering colonies producing 112 lbs. while the combless packages produced 111 lbs. The cost of wintering a colony of bees was found to be $7.40 and the total cost of a 2-lb. package $6.72. Experiments indicated that the flying weight of the field bees was about 82 mg., or approximately 5,500 bees per pound. "It was found that a bee readily carries half its own weight in nectar and that in extreme cases they might carry up to 80 per cent of their weight. Another series of tests indicated that a bee required about one hour for a round trip while gathering honey. These figures would indicate that 2 lbs. of field bees could carry a pound of nectar an hour during a period of abundant honey flow. This would mean about 6 lbs. of honey per day under favorable conditions for such a swarm. Just what percentage of bees are available for field work has not been determined, but at least 4 lbs. of field bees would undoubtedly be present in a strong colony. This would mean a maximum gathering of 12 lbs. of honey per day. About one-fourth of this weight will be lost by evaporation and consumption, leaving a net gain of about 9 lbs. This agrees very closely with gains made by strong colonies under favorable conditions, and therefore these figures appear to be pretty accurately determined. . . .

"It was found that a bee gathers honey from only one plant at a time. Dandelions gave their maximum honey flow the second week in May, basswood during the first half of July, while heartsease came on the last half of August. Basswood honey was very abundant and the bees made big gains, but there was a great shrinkage, while on the other hand heartsease made moderate gains but the nectar was very thick and lost little by evaporation. The highest producing colony in the experimental apiary made 200 lbs., while the average was 143."

[Report of the] department of entomology, H. T. FERNALD and A. I. BOURNE (*Massachusetts Sta. Rpt. 1919, pp. 31a–37a*).—In reporting upon the occurrence of insect pests during the year, it is pointed out that in several instances the European corn borer was reported as working far outside its known limits of infestation.

In potato-spraying experiments with arsenicals it was found that arsenates of lead, calcium, and magnesium are apparently equally good in every way except as to suspension quality and cost. The arsenate of calcium was found to settle to the bottom of the spray tank the most rapidly, magnesium arsenate being a little slower, while the lead arsenate remained unsettled much longer than the other two. Based upon average quotations for 1919, the cost of 50 gal. of spray for the lead arsenate used was 66 cts., for the magnesium arsenate 50 cts., and for the calcium arsenate 45 cts. In the tests conducted it was found that the excess of lime required where calcium arsenate was used was supplied by Bordeaux mixture.

Tests were made of Sulfoleum, which is claimed to be a miscible oil containing a considerable percentage of sulphur in solution, in comparison with nicotin sulphate 40 per cent. The Sulfoleum was found to mix rapidly with water, and did not separate from it on standing even for some time. It was quite effective against plant lice, though not quite so effective as nicotin sulphate. While it did injure tender foliage, the injury was not excessive, although sufficient to make it a serious objection. It was found to be of some value when applied as a cluster-bud spray for the control of red bugs, and without injury in this case to the foliage.

The green clover worm (*Plathypena scabra* Fab.) became extremely abundant during the summer and caused serious injury to beans, by stripping the leaves and eating into the pods, almost everywhere in the State. Its work was first noticed in the eastern part a little after the middle of July, and a week or so later was evident farther west. In control work calcium and magnesium arsenates burned the foliage badly, whereas lead arsenate gave entire success, particularly if applied before the leaves had been badly riddled. It is pointed out that when this arsenical is applied when the pods are nearly ready for picking they must be thoroughly washed before being marketed.

Citrus thrips, W. V. TOWER (*Porto Rico Sta. Rpt. 1919, pp 24, 25*).—Observations were made of thrips (species not stated) on grapefruit during the spring blossoming period. While the average number of thrips per grapefruit bloom was 27, no damage seemed to have resulted.

Investigation of the nature and cause of the damage to plant tissue resulting from the feeding of capsid bugs, K. M. SMITH (*Ann. Appl. Biol., 7 (1920), No. 1, pp. 40–55, pl. 1, figs. 5*).—"There are several species of capsid bugs [in England] which normally feed on the leaves and fruit of apple trees, but only one causes any damage, i. e., *Plesiocoris rugicollis*. This species produces the death of the tissues surrounding each puncture in the leaves made in feeding and on the fruit produces great distortion and 'russeting.' There are three possible explanations of this damage: (1) A purely mechanical injury produced by the insect's stylets in process of sucking, (2) the possibility of the bug acting as a 'carrier' of bacteria and by injecting these into the plant along with the saliva sets up a pathological state, (3) the injection of some secretion from the salivary glands which has a violently toxic effect on the plant tissue. It was found impossible to reproduce by mechanical means the injury resulting from the feeding of *P. rugicollis*, also the fact that the other species of capsid bug feed in a similar manner and produce no injury militates strongly against the theory of mechanical injury only. As regards the second

theory, no bacteria could be discovered in microtome sections of either damaged plant tissues or the salivary glands of the bug, and all attempts to reproduce the damage by means of bacteria failed. The third theory was proved to be the correct explanation by several experiments and observations.

"Experiments were made to try and reproduce the bug injury with various dilute poisons; in most cases a very similar appearance was produced in the foliage, but the attempts were unsuccessful in the fruit itself with the exception of the very great retarding effect in the growth of the fruit, which is one of the results of the bug injury. By feeding the bugs on slices of potato instead of apple the same effect was produced but on a magnified scale. The salivary glands of *P. rugicollis* and of *Lygus pabulinus*, a bug harmful to potato foliage, when placed on a freshly cut slice of potato in a petri dish, produced a violent reaction which killed much of the tissue surrounding the glands. The same experiment was carried out with the glands of one of the harmless apple-feeding bugs, *Psallus ambiguus*, but these had no effect whatever on the potato. When the salivary glands of *P. rugicollis* were pricked into apple buds, the shoots were killed within 24 hours. The salivary glands of *P. ambiguus* when similarly treated had no effect."

Observations were made showing the rate of exudation of sap from the bug's puncture in the potato, and these are given for *P. rugicollis* and *L. pabulinus*. A list of common plants and fruit trees with their various reactions to the feeding of harmful bugs is included.

The black fly of citrus and other subtropical plants, H. F. Dietz and J. Zetek (*U. S. Dept. Agr. Bul. 885 (1920), pp. 55, pls. 11, figs. 7*).—This is a summary of the present status of knowledge of *Aleurocanthus woglumi* Ashby, known as the black fly or spiny citrus white fly, based upon a review of the literature and investigations conducted by the authors in large part in the Canal Zone from June, 1918, to August, 1919. This pest was introduced into Jamaica from India on infested food plants within the last 10 to 15 years, from which focus it has spread to Cuba, New Providence, the Canal Zone, the Republic of Panama, and Costa Rica. It is thought to have been introduced into the Canal Zone between the years 1912 and 1914.

"The introduction and establishment of this pest in widely separated areas has taken place through nursery stock or infested individual food plants, including cuttings for propagation. Within a region this method of spread is supplemented by the natural flight of the adults, by their carriage on vehicles and trains, and on the clothing of persons passing or working among infested trees.

"The important food plants of this insect in the Canal Zone are *Ardisia revoluta*, various species of the genus Citrus, *Coffea arabica*, *Eleais melanococca*, *Eugenia jambos* and *E. malaccensis*, *Lucuma mammosa* and *L. nervosa*, *Melicocca bijuga*, and *Mangifera indica*. This insect, under certain conditions, injures seriously plants infested by it, but no plants killed by it have been found in the Canal Zone and Republic of Panama.

"There are six stages in the life history of the black fly, namely, the egg, three larval instars, the pupa, and the adult. The life history is not clear-cut, and there is a decided overlapping of stages. The length of time for the completion of one generation ranges from 45 to 113 days. The duration of the various stages are: Egg, 11 to 20 days; first larval instar, 7 to 16 days; second larval instar, 5 to 30 days; third larval instar, 6 to 20 days; pupa, 16 to 80 days; adult, probably 6 to 12 days.

"There is a great mortality in the various stages, only 22.5 per cent of the individuals of 790 eggs reaching maturity. The natural climatic factors that

tend to hold the insect in check in the Canal Zone are drying out during the dry season and the heavy rains during the wet season.

"Five species of coccinellids and one species of Chrysopa have been found to be predacious on the various stages of *A. woglumi*, but they are not as yet sufficiently abundant to be important factors in its control. No internal parasites were found.

"The black fly can be controlled by contact insecticides. Five and ten per cent kerosene emulsions, fish-oil soap at the rate of 1 lb. to 2 and to 4 gal. of water, and nicotin oleate have given good results.

"There is a possibility that this insect may gain entrance into and become established in the United States, particularly Florida."

A list of 37 references to the literature is included.

Gipsy moth tree-banding material: How to make, use, and apply it, C. W. Collins and C. E. Hood (*U. S. Dept. Agr. Bul. 899 (1920), pp. 18, pls. 7, figs. 4*).—This is a detailed account of a tree-banding material which has been perfected by the Bureau of Entomology working in cooperation with the Federal Insecticide Board. An account of the original formula and the results secured by it, by Burgess and Griffin, has been previously noted (E. S. R., 37, p. 258). The formula now in use, which varies somewhat in proportion and in the method of mixing from that given in the previous account, consists of (1) coal-tar neutral oil having a density of 1.12 to 1.15 at 20° C. (68° F.); (2) hard coal-tar pitch, melting point at about 49°; and (3) rosin oil, known as first run "kidney," having a viscosity of 52 at 100°, tested with a Saybolt universal viscosimeter. It is pointed out that a neutral or nearly neutral coal-tar oil must be used, as coal-tar acids are sometimes injurious to trees, and that some rosin oils contain more free acid than others, those with the high acid content giving the best results.

Included in the account of equipment used is a sectional view of a kettle or mixer of 25 gal. capacity with the detailed arrangement of the transmission and paddles for use in preparing the material. In discussing the application of the bands, a detailed plan is given of the tree-banding gun with its dimensions and the metals used. The account includes a discussion of the value of banding trees in woodlands, along fences, or near stone walls; practicability of treating gipsy moth egg clusters and of banding trees *v.* power spraying; resurfacing old bands of gipsy moth tree-banding material; behavior of caterpillars beneath gipsy moth tree-banding material and its effect upon those crossing the bands; effect on bark of trees; value of banding apple trees located near woodland infested by the gipsy moth; and species of insects against which it is effective. Observations made of a number of species of larvæ found in woodlands where bands were applied showed the following larvæ to have been barred or having ventured into the bands were unable to free themselves: Gipsy moth, brown-tail moth, white-marked tussock moth, rusty tussock moth (*Notolophus antiqua* L.), forest tent caterpillar, checkered tussock (*Halisidota tessellaris* S. and A.), fall webworm, American silkworm (*Telea polyphemus* Cram.), fall cankerworm, spring cankerworm, elm spanworm, and the green fruit worm.

The cost of making and applying this material is said to be from 1.08 to 1.42 cts. per linear foot, depending upon the width of bands used, whereas the sticky compounds on the market cost 2.56 cts. per linear foot. It is pointed out that bands of this material may be retouched or resurfaced and kept in working condition each year with very small cost.

Grapevine looper [Lygris diversilineata Hübn.], D. Isely (*U. S. Dept. Agr. Bul. 900 (1920), pp. 15, pls. 4*).—This geometrid has been known as a

grapevine pest for more than 70 years. In the present paper the author records studies of its biology and control, conducted at North East, Pa., during the seasons of 1916 and 1917. The species is found in northeastern United States and southern Canada, and has been collected by the author in New York, Pennsylvania, and Ohio. In addition to grape the author has observed it feeding on Virginia creeper.

"There is one generation annually in the Erie-Chautauqua grape belt, winter being passed in the egg stage. Insectary records in 1917 show that eggs hatched from June 2 to June 15, inclusive. Field observations, while indicating that a few individuals may have hatched a week or more earlier, showed that the great majority of the eggs must have hatched during the first two weeks of June, confirming the insectary records. The hatching of larvæ in numbers occurred about three weeks before the grape blossoming period in 1917. The duration of the feeding period of most larvæ was from 6 to 7 weeks, averaging 46.12 days. Preparatory for pupation the larva secures itself by a loose web spun on a fold of a leaf or grape cluster. Two days are spent as prepupa and about 10 as pupa. The moth emerges in midsummer and deposits eggs which hatch the ensuing year.

"It should be noted that the season of 1917 was a very late one, the grape blossoming period being about three weeks later than usual. It might be expected, therefore, that in a normal season the larvæ would hatch in considerable numbers in May and the earliest moths might even appear in June."

The species is by far the most abundant minor pest of the grapevine, but so far as the author has observed it has never caused serious injury except to grape arbors and garden vines. Hellebore and other insecticides formerly used have been superseded by arsenate of lead. It was found that 1.5 lbs. of arsenate of lead powdered, or 3 lbs. of paste, to 50 gal. of liquid was the minimum strength that would kill larvæ in all stages.

A list is given of 26 references to the literature cited.

The habits of the glasshouse tomato moth (Hadena (Polia) oleracea) and its control, L. Lloyd (*Ann. Appl. Biol*, 7 (1920), No. 1, pp. 66–102, pls. 3, figs. 4).—"*H. oleracea* is not a normal pest of tomatoes grown under glass, and where it has become established as such it is still in some respects ill adapted to a greenhouse life on a tomato diet. The larvæ eat the fruit because many of them are unable to survive on the foliage alone. In spite of this weakness it has become a serious pest because the species is a prolific one and, once having entered a greenhouse it usually becomes a prisoner there. In a normal year there are two complete generations and a partial third, and the moths are present in the house continuously from February to October.

"Spraying the young plants with arsenate of lead largely controls the first brood of larvæ, but not entirely, because moths of the first flight of the year are still emerging when it is not practicable to use a poisonous spray on the plants. The plants should be sprayed three times when the larvæ appear early, (1) when the seedlings are in pots, (2) just after planting out, (3) about a month before fruit picking begins. The last operation is the most important, and the two previous ones may be omitted if there are no signs of larvæ feeding.

"Systematic moth trapping must be done throughout the growing season, because it will reduce the numbers of moths which pass out of the houses, and these, or their offspring blunder into the same or neighboring greenhouses; and also because it is the most effective form of control when spraying is not practicable, and will reduce the infestation to a very great extent. Sixty jars baited with ale, treacle, and 1 per cent sodium fluorid should be used to each acre of glass. The dead moths should be removed frequently, and the jars

should be rebaited every third week. Broken fruit must not be allowed to lie about in the houses, as the moths feed on this and become more prolific. Many full grown larvæ may be trapped in sacks placed about the houses. The sacks should be collected and dipped in boiling water every third week.

"Pupæ should be destroyed in the winter. Special baskets should be kept for fruit picking, and those from the markets should never be allowed in the houses.

"The pest spreads rapidly through areas where the nurseries are congested owing to the escape of moths from the infested houses. It may be introduced into isolated localities by means of market baskets, or by plants purchased from infested nurseries. On its first appearance every method of control should be applied at once, as attempts to check it by picking off the larvæ by hand in trade nurseries have almost invariably ended in failure."

Life history of the grape-berry moth [Polychrosis viteana Clem.] in northern Ohio, H. G. Ingerson (*U. S. Dept. Agr. Bul. 911 (1920), pp. 38, figs. 5*).—This is a detailed report of seasonal history studies conducted during 1916, 1917, and 1918 at Sandusky, Ohio, and vicinity, in cooperation with the Ohio Experiment Station, which are presented in large part in tabular form. The results of control experiments have been published as Bulletin 837 (E. S. R., 43, p. 454).

In northern Ohio one full brood and a partial second are produced, the second brood of larvæ being much larger and more destructive than the first. The species hibernates in the pupal stage in cocoons in old grape leaves under the grape trellis. Under such conditions in the protected part of the vineyard the mortality among the pupæ was 80 per cent during the winter of 1916-17 and 76 per cent during the winter of 1917-18.

"The first moths emerge in the spring about 10 days before grapes begin to bloom, but emerge in greatest numbers during and immediately following the period of grape bloom. In 1917 but 4 per cent emerged previous to bloom, 50 per cent during grape bloom, 25 per cent in the 10-day period following bloom, and the remaining 21 per cent later in the season. Moths begin ovipositing about 4 days after emergence and the eggs hatch in from 3 to 10 days, with 5 days as the average length of the egg stage.

"The first-brood larvæ feed in the young grapes for a period of from 14 to 37 days, and the average length of the feeding period was 20.6 days in 1917. At the end of the feeding period the larvæ leave the grapes and go to tender grape leaves on the vines, in which they spin their cocoons. The prepupal period lasted for from 1 to 3 days and averaged 1.77 days with the first brood in 1917, and lasted for from 3 to 7 days and averaged 4.15 days with the second brood in 1916. The pupal period varied from 11 to 16 days and averaged 13 days for the first-brood pupæ in 1917. The total period in the cocoon varied from 6 to 32 days with an average period of 15 days.

"The life cycle of the first generation in 1917, taken as a total of the average length of the separate stages, was 39.79 days. The total of the maximums was 76 days and of the minimums 23 days.

"The incubation period of second-brood eggs varied from 4 to 10 days with 5.1 days as the average period. The feeding period of second-brood larvæ was from 16 to 36 days and averaged 24.18 days in 1916. All other records have given this period as about 40 days, which is probably nearer the average condition than the figures presented here.

"Second-brood larvæ begin to leave the fruit early in the fall (August 22, 1916, August 15, 1918, September 7, 1917), but leave in greatest numbers just previous to and during the early part of the harvest season. In 1916, 77 per

cent of the larvæ left the fruit previous to the beginning of the Concord harvest and 90 per cent previous to the beginning of the Catawba harvest. In 1917 corresponding figures were 56 per cent and 94 per cent."

In each brood of moths the females occur in much larger number than the males, the proportion of males being 21 per cent in the spring brood, 1917; 18 per cent in the summer brood, 1917; 25 per cent in the spring of 1918; and 21 per cent in the summer brood of 1918. A small part of the first-brood larvæ do not transform to months the same season but hibernate and emerge as moths the following spring. In 1918 this amounted to 5.9 per cent of the total number recorded. Of the same lot of larvæ but 1.4 per cent were parasitized.

"Mating and egg deposition were observed during these investigations. The habit of the grape-berry moth larvæ of feeding on grape leaf galls formed by the grapevine phylloxera was noted. Extreme resistance of the larvæ to low temperature was also noted, live larvæ persisting after a minimum temperature of 17° F. had occurred. Parasitism was very low and of little consequence as a control during these investigations.

"Control measures recommended are cultural methods which will leave the overwintering pupæ exposed to the elements as much as possible. Satisfactory control was effected by two spray applications by the "trailer" or hand method of spraying. The first application should be made 3 to 5 days after the young grapes set and the second when the grapes first touch in the clusters."

The red-banded leaf roller [Eulia velutinana Walk.], F. H. Chittenden (*U. S. Dept. Agr. Bul. 914 (1920), pp. 14, figs. 5*).—This is an account of *E. velutinana*, a small greenish caterpillar, about 0.75 in. long when mature, which attacks the foliage of beans, sweet potato, asparagus, strawberry, raspberry, and various other crops, and at times attracts considerable attention. It rolls the leaves in various ways, according to the nature of the plant attacked, and breeds continually throughout the growing season, from April to November. The species, which is native to this country, is widely distributed from Maine to Texas, and has been found in California. The paper summarizes the present status of information on the pest and reports studies made in the District of Columbia and vicinity.

It hibernates exclusively in the pupal stage, for a period of five months. The incubation of the egg requires about 11 days, 22 days being required for the development of the larva, and a minimum of 6 days for the pupa. There are said to be at least two and probably three generations annually in the latitude of Washington.

Several ichneumonid and other parasites are known to attack it. The pest is seldom sufficiently abundant to warrant artificial methods for its control, and since it conceals itself in rolled-up leaves it is difficult to reach with insecticides. The fact that it issues from its shelter to feed on surrounding foliage makes it possible to reach it at that time with a spray of lead arsenate. Clipping the webbed leaves from the affected plants, early fall plowing, and burning over affected areas after the crop is off, will help to hold the insect in check.

A list is given of 22 references to the literature.

Notes on chemotropism in the house fly, E. R. Speyer (*Ann. Appl. Biol., 7 (1920), No. 1, pp. 124–140*).—The author concludes that "essential oils are unattractive to the house fly in general. Certain essential oils evoke negatively chemotropic stimuli, these being oil of *Pinus sylvestris*, orange oil, lemon oil, citronella oil, oil of juniper berries, and possibly camphor oil. Certain essential oils are inactive in raising stimuli, these being cedar oil, eucalyptus oil, and oil of bitter almonds. They may themselves be neither positively nor nega-

tively chemotropic in action but probably have slight negative features. During evaporation the repellent actions pass off, soonest in orange oil and later in lemon oil, citronella oil, and oil of *P. sylvestris*, and some coordination may occur in relation to the rate of evaporation and the retention of repellent qualities."

Grapevine flea-beetles [Altica chalybea Ill. and A. woodsi n. sp.], D. Isely (*U. S. Dept. Agr. Bul. 901 (1920), pp. 27, pls. 4*).—This is a report of studies of the life history of the grapevine flea-beetles, including rearing records and field observations made at North East, Pa., during the seasons of 1916 and 1917 and miscellaneous field observations during the two seasons previous. In the small form, which has a different seasonal history, the author recognizes a new species which he describes as *A. woodsi*. The name lesser grapevine flea-beetle is given to it.

There is only one generation annually of the grapevine flea-beetle (*A. chalybea*) which passes the winter in the adult stage. "Beetles emerge from hibernation when the grape buds are swelling, and oviposition begins soon after and continues until about the middle of June, a few days before the latest adults disappear. The average duration of the incubation period in 1917 was 15.18 days. The larval feeding period averaged 24.26 days in 1917. Records of feeding larvæ began June 4 and continued until July 20. The duration of the different larval stages was as follows: First stage, 8.74 days in 1917, second stage 6.95 days in 1917, third stage 7.75 days in 1916 and 8.53 days in 1917. The duration of the period in the ground averaged 20.71 days in 1916 and 19.24 days in 1917. Records taken during the two years on the transformations of this beetle while in the ground extended from June 22 to August 4. The duration of the different stages in the ground in 1917 was as follows: Prepupa 9.17 days, pupa 8.47 days, callow adult 2 days."

The seasonal history of the lesser grapevine flea-beetle (*A. woodsi*) is similar in general to that of the grapevine flea-beetle, but it is later throughout. There is a single generation annually, winter being passed in the adult stage. "Beetles emerge from hibernation in the latter part of May or early June, some time after the grape shoots have expanded, or about three weeks later than the typical species. Oviposition begins early in June and continues until the latter part of July, when the last adults disappear. The average duration of the incubation period was 12.82 days in 1916 and 13.72 days in 1917, slightly less than that of the larger species, but this difference may be accounted for by the fact that these incubation records were taken later in the season, when the temperature was higher. Larvæ are found on the vines in midsummer, the records of collection extending from June 18 to August 8. The average duration of the larval feeding period was 18.71 days in 1916 and 18.59 days in 1917, or about one-fourth shorter than that of the 'large form.' The duration of the three larval stages was as follows: First stage 6.16 days in 1916 and 6.35 days in 1917, second stage 6.46 days in 1916 and 6 days in 1917, third stage 6.51 days in 1916 and 6.62 days in 1917. The maximum limits of records of individuals transforming in the ground were from July 7 to August 29. The duration of this period of transformation averaged 16.15 days in 1916 and 14.5 days in 1917, or about 5 days less in each season than those required for the 'large form.' The average duration of the different stages in the ground was as follows: Prepupa 4.68 days, pupa 7.24 days, callow adult 2.19 days. After emergence from the ground the beetles feed until late in autumn and then go into hibernation."

A comparison of the seasonal history of the two species shows the lesser species to appear in the vineyard about three weeks later than the other. Their

economic importance, predatory enemies, and methods of control are discussed. Both species are sporadic in their occurrence from season to season and they are now restricted in their distribution largely to vineyards adjacent to wild grape arbors. A number of predatory enemies, of which *Lebia viridis* Say is the most important, contribute to its natural control. Where, as is usually the case, the infestation covers only a small area, hand-picking the beetles will probably be the most effective as well as the cheapest means of control, while if a large area is infested, spraying with arsenate of lead, 3 lbs. paste or 1.5 lbs. powder to 50 gal. of water, may be necessary.

A list is given of 26 references to the literature cited.

A new avocado weevil from the Canal Zone, H. F. Dietz and H. S. Barber (*Jour. Agr. Research [U. S.], 20 (1920), No. 2, pp. 111–116, pls. 3*).—A description and brief account is given of *Heilipus perseæ* Barber (n. sp.), which attacks the seed of avocado in the Canal Zone.

Injury to the fruit and to the leaves and stems is caused by the adults. The eggs appear to be laid at the junction of the skin of the fruit and the pulp when the fruit is between one-half and three-fourths mature, as many as ten having been found on a single fruit. After hatching, the larvæ bore through the pulp before entering the seed, thus rendering a considerable part of the fruit inedible. Once they enter the seed their activities are confined to it. When a seed becomes infested with two or more larvæ, it is usually so badly riddled that it can not germinate.

While the length of the larval stage has not been determined, the indications are that it is not less than three months. Upon becoming full grown the larvæ hollows out a large spherical cell in which it pupates. The minimum duration of the pupal stage is 12 to 15 days. There is thought to be but a single generation in a year. Control consists in gathering up and burning the fallen fruits and seeds.

On a new polyembryonic encyrtid (Chalcidoidea) Copidosoma tortricis n. sp. bred from the strawberry tortrix moth, J. Waterston (*Ann. Appl. Biol., 7 (1920), No. 1, pp. 1–5, figs. 5*).—Under the name *C. tortricis* the author describes a new encyrtid reared in numbers from *Oxygrapha comariana* Zell. at Cambridge, England.

FOODS—HUMAN NUTRITION.

Food materials, their substitutes and artificial food preparations, R. Scherer (*Lebensmittel deren Ersatzstoffe und Künstliche Nährpräparate. Vienna and Leipzig: A. Hartleben, 1919, pp. XV+482*).—This volume consists of brief descriptions of the preparation and preservation of various food materials, beverages, and condiments, and of substitutes for the same. Data on the composition of some of these substances and recipes for their preparation are included.

Mulatinhos, a new edible Brazilian bean, C. Grimme (*Pharm. Zentralhalle, 61 (1920), No. 31, pp. 421–423*).—Analyses are given of Mulatinhos, a variety of *Phaseolus vulgaris* giving a negative HCN test. The composition of the raw beans was as follows: Moisture 11.3 per cent, dry matter 88.7, crude protein 34.1, crude fat 1.1, nitrogen-free extract 46.4, crude fiber 3.5, and ash 3.6 per cent. The digestible material is given as crude protein 29.3, crude fat 0.7, nitrogen-free extract 43.2, crude fiber 1.6, digestible protein 25.3 per cent and starch value 68.7 kg. per 100 kg.

A comparison of the composition of the beans before and after cooking in water, with and without treatment with soda, shows a considerable loss of nutritive matter in the cooking liquid.

Some nutritive properties of nuts; their proteins and content of water-soluble vitamin, F. A. CAJORI (*Jour. Biol. Chem., 43 (1920), No. 2, pp. 583–606, figs. 8*).—The studies reported included feeding experiments with rats to determine whether the proteins in nuts are complete from a nutritive point of view, and also to determine the relative content of various nuts in water-soluble vitamin.

In the first series of experiments the nuts were crushed and pressed to remove part of the oil and thereby increase the protein content to such an extent that it could be incorporated at an 18 per cent level in a basal diet adequate in respect to everything but protein. In the vitamin studies nuts were fed separately in known amounts apart from, and in addition to, a basal diet free from water-soluble vitamin. Both restorative and preventive experiments were made.

The growth curves presented show that growth at a normal rate resulted on diets employing almond, English walnut, filbert, and pine nuts as sole sources of protein. Growth was somewhat below normal in the experiments employing pecans until casein was substituted for part of the pecan protein, when normal growth ensued.

Normal growth resulted when rats were fed upon otherwise adequate diets containing the almond, English walnut, chestnut, Brazil nut, black walnut, or pecan as the sole source of water-soluble vitamin. Other animals which had declined on a diet devoid of water-soluble vitamin recovered promptly when the almond, English walnut, filbert, hickory, pine nut, chestnut, or pecan was introduced into the diet. In general a daily ration of 0.5 gm. of the nut proved insufficient and 2 gm. sufficient to support normal growth. The pecan and chestnut furnished sufficient quantities of the vitamin in 1 gm. daily rations.

Attention is also called to the fact that rats on diets in which nuts furnished the sole source of protein were able to nurse their young successfully, thus indicating that the proteins of these nuts furnished the necessary amino acids for milk production.

The blood-drying method of Dr. Sgalitzer, H. MESSNER (*Ztschr. Fleisch u. Milchhyg., 30 (1920), Nos. 18, pp. 237–239; 19, pp. 253–255*).—This is a description of a patented process for the vacuum dehydration of defibrinated slaughter-house blood for use in cooking, together with testimonials as to its value in food preparations.

Products and utilization of muscadine grapes, W. J. YOUNG (*South Carolina Sta. Bul. 206 (1920), pp. 37, figs. 4*).—This bulletin describes methods for the home utilization of muscadine grapes not needed in the fresh state. The necessary equipment for the preparation of the products described is discussed briefly, and suggestions summarized in tabular form are given for the adaptation to special uses of the principal varieties of muscadine grapes. Following this, directions are given for the preparation of unfermented grape juice by the cold press and hot press methods, of sirups, and of various preserves, pie fillings, etc.

[Preserving and drying in the home], F. P. LUND (*Bul. Mens. Off. Renseig. Agr. [France], 19 (1920), pp. 174–216, figs. 8*).—This article is a condensation of the information on canning and preserving given by the author and other representatives of the U. S. Department of Agriculture at the conferences and demonstrations in France under the auspices of the American Committee for the Devastated Regions of France. A preface by B. C. Davis on the history of the girls' clubs organized by the extension service of the Department is included.

Heat penetration in processing canned foods, W. D. BIGELOW, G. S. BOHART, A. C. RICHARDSON, and C. O. BALL (*Natl. Canners Assoc. Bul. 16–L (1920), pp. IV+128, figs. 89*).—This bulletin presents the results of work thus far con-

ducted at the Research Laboratory of the National Canners Association in the study of heat penetration in processing canned foods. In an introductory chapter brief statements are made of the influence of different factors on heat penetration and of heat penetration in the sterilization of canned foods. This is followed by a detailed discussion of the apparatus and methods employed and the results obtained with individual products. The data throughout are presented in the form of heat penetration curves with time in minutes as abscissas and temperature changes in degrees Fahrenheit as ordinates.

Heat penetration in processing canned foods (*Canner, 51 (1920), No. 18, pp. 45, 46*).—Excerpts from the bulletin noted above.

Nutrition experiments with rats.—A description of methods and technique, E. L. FERRY (*Jour. Lab. and Clin. Med., 5 (1920), No. 11, pp. 735–745, figs. 9*).—This is a description of the technique employed in the nutrition investigations with rats conducted under the direction of Osborne and Mendel at the Connecticut State Experiment Station. The article is illustrated by photographs of the experimental cages, weighing devices, and food tubes and cups.

The influence of saccharin on the catalases of the blood, F. C. BECHT (*Jour. Pharmacol. and Expt. Ther., 16 (1920), No. 3, pp. 155–197, figs. 12*).—The author reviews briefly the recent conflicting conclusions of Burge (E. S. R., 40, p. 864) and Stehle (E. S. R., 42, p. 259) concerning the effect of saccharin upon the catalases of the blood and reports the results of further study of this action in cats and dogs, using the method described in an earlier paper (E. S. R., 41, p. 172).

The data reported tend to confirm the conclusions of Stehle that the ingestion of saccharin has no appreciable effect on catalase production. Wide variations of the catalase power of the blood were noted in the case of two dogs studied over a period of from 73 to 91 days, but the variations were as great in the control as in the test animal. When saccharin was injected into the veins instead of the gastrointestinal canal a marked decrease in the catalase content of the blood was produced, which is thought to have been due to the direct action of the drug upon the cells of the blood.

Removal of the pancreas had no specific influence on the catalase content of the blood, and the action of saccharin was the same in the animal with pancreatic diabetes as in the normal animal. Determinations were also made of the catalase content of the blood of 7 diabetic and 8 nondiabetic patients before and after the ingestion of 1 gm. of saccharin. The catalase content rose in 66 per cent and fell in 33 per cent of the diabetic cases, and under the same conditions fell in 97 per cent and rose in 20.8 per cent of the nondiabetic cases. "While this effect in diabetic cases is markedly different from our findings on normal animals and also from nondiabetic cases in man, it is not believed that the observation is of any significance whatever, for it is believed that a longer series under better control would show that the variations were entirely within normal limits."

Amino acids in nutrition, B. SURE (*Jour. Biol. Chem., 43 (1920), No. 2, pp. 443–468, figs. 17*).—Two papers are presented.

I. *Studies on prolin: Is prolin a growth-limiting factor in arachin (globulin from the peanut)?* (pp. 443–456).—The author presents evidence from growth curves of young rats on a diet in which the protein was furnished by arachin with and without various supplements that arachin is a biologically poor protein in spite of the fact that chemical analysis indicates absence of no necessary amino acids. That prolin is not the growth-limiting factor in arachin is shown by the fact that neither prolin itself nor gelatin or zein, which are high in prolin, were able to supplement the deficiencies of the arachin and promote growth. Trypto-

phan and cystin, when added to the extent of 2.5 and 1 per cent of the total protein, respectively, did not bring about improvement, nor did the leucin fraction composed of a mixture of alanin, leucin, and valin. Lactalbumin, particularly in the presence of cystin, appeared to supplement arachin to a certain extent.

II. *The nutritive value of lactalbumin: Cystin and tyrosin as growth-limiting factors in that protein* (pp. 457–468).—This paper reports a study of the growth-limiting factors of lactalbumin specially prepared from the whey produced in the maufacture of cottage cheese and further purified by treatment with chloroform and water and subsequently with hot alcohol. This lactalbumin, when fed as 12 and 18 per cent of a ration including 2 per cent of the total protein in the form of nitrogen of unknown source in an alcoholic extract of wheat embryo to furnish the water-soluble vitamin, was found to be inadequate for growth. The addition of 1 per cent of cystin brought about normal growth, thus indicating that cystin is the primary or growth-limiting factor in lactalbumin. The lactalbumin, when fed at a 9 per cent plane of intake, even in the presence of 1 per cent of the total weight of the protein in the form of cystin, proved inadequate, but when fortified with tyrosin to the extent of 5 per cent of the total protein was found to be of excellent nutritive value, thus indicating that tyrosin is the secondary growth-limiting factor in lactalbumin.

The fact that Osborne and Mendel found lactalbumin to be a highly efficient protein when fed with protein-free milk (E. S. R., 38, p. 568) is suggested by the author to be due to cystin in the protein-free milk, analyses having shown it to have a total sulphur content of 0.2 per cent, the greater part of which is in organic form. Protein-free milk was also found to give qualitative tests for tyrosin.

The relative value of fat and carbohydrate as sources of muscular energy.—With appendices on the correlation between standard metabolism and the respiratory quotient during rest and work, A. KROGH and J. LINDHARD (*Biochem. Jour., 14 (1920), No. 3–4, pp. 290–363, figs. 23*).—This paper reports an elaborate investigation of the problem of the immediate source of muscular energy or the coefficients of utilization of different sources of energy, conducted by the authors with the collaboration of G. Liljestrand and K. G. Andresen. The plan of the research consisted in determining in 20-minute periods the respiratory exchange of human subjects doing constant work on an ergometer placed in a Jaquet respiration chamber. The subjects for a number of days before and during the experimental period were on definite diets containing a minimum of protein and a very decided preponderance of either fat or carbohydrate. By the use of a modified Jaquet apparatus, which is described and illustrated, and the special gas apparatus for analyzing the respiratory gases described previously (E. S. R., 44, p. 202), the technical error in the determinations of total metabolism has been found to be below 1 per cent and the respiratory quotient determinations to have a maximum error of 0.005 per cent.

Four series of experiments including about 220 determinations were made on six different subjects. Four of these subjects observed distinct differences in the facility with which the prescribed amount of work was performed with changes in diet, the fatigue on fat diets in all of these cases being much greater than on carbohydrate diets. In one of these subjects a perceptible difference was also noted between work on a mixed diet and on a carbohydrate diet. Two of the subjects felt no appreciable difference between work on different diets. A statistical study of the data obtained in the investigation is summarized as follows:

"The net expenditure of energy (standard metabolism deducted) necessary to perform one calorie technical work on the ergometer has varied between about

5.5 and 4 calories. At a constant quotient it varies with the subject and for the same subject it decreases with increasing training. During one hour of work it generally rises slightly from fatigue.

"For the single subject and on a constant level of training the relation between the respiratory quotient and the net expenditure of energy per unit work can be expressed graphically as a straight line. Since the proportiton of fat to carbohydrate catabolized is also a straight line function of the quotient the difference in value for muscular work between fat and carbohydrate can be expressed by a single figure: The waste of energy from fat. In the three best series of experiments the net expenditure of energy per calorie technical work varies from about 4.6 calories when fat alone is catabolized (R. Q.=0.71) to about 4.1 calories when carbohydrate alone is catabolized (R. Q.=1). The waste of energy from fat is 0.5 calorie, or 11 per cent of the heat of combustion of the fat.

"The standard metabolism (during rest, in the postabsorpttive state) of a human subject is not independent of the preceding diet. When the diets are poor in protein it is lowest at intermediate quotients, and increases about 5 per cent when the quotient falls to about 0.71 and about 3 per cent when the quotient rises to about unity.

"On the transition from rest to moderate muscular work the respiratory quotient is generally altered. On an average it was increased when the quotient was low and diminished when it was high before the work. The fall at high quotients is greater (0.05) than the increase at low (0.03). At quotients between 0.8 and 0.9 the average change on the transition to work is very slight.

"It is suggested as a working hypothesis that both during rest and during work the proportion of fat to carbohydrate catabolized is a function of the available supplies of these substances; that carbohydrate is formed from fat and provisionally stored when the quotient is below 0.8, while a corresponding transformation of carbohydrate to fat takes place when the quotient is above 0.9; that these anabolic processes make the total respiratory quotient lower than the catabolic when this is low and higher when it is high, and that they give rise to an extra expenditure of energy during rest; and finally that during work the anabolic processes (combined with storage) are not increased in proportion to the catabolic, whereby the total quotient is lowered when it was high and raised when it was low beforehand."

Studies on carbohydrate metabolism in rabbits (*Jour. Biol. Chem., 43 (1920), No. 2, pp. 491–519, figs. 3*).—This report of an investigation of the metabolism in rabbits of a number of carbohydrates such as are found in dietaries of infants consists of two papers, as follows:

I. *Observations on the limits of assimilability of various carbohydrates*, L. B. Mendel and M. R. Jones (pp. 491–506).—In the study here reported the limits of assimilability of various carbohydrates were determined by administering to rabbits, on a diet of corn, oats, water, and a little fresh cabbage, known amounts of water solutions of the carbohydrate to be tested, and examining the urine for sugar with Benedict's reagent before and 3½ hours after the administration of the sugar. The dosage of sugar was increased 1 to 3 gm. per kilogram until sugar appeared in the urine, the smallest amount of sugar which resulted in glycosuria being recorded as the assimilation limit for the sugar in question.

For the individual carbohydrates studied, tolerance in rabbits occurred in the following order of increasing assimilability: Sucrose, levulose, glucose, maltose, and dextrin. Maltose-dextrin and glucose-dextrin mixtures were highly assimilable although somewhat less so than pure maltose or dextrin. A sucrose-dextrin mixture was the least assimilable of all the carbohydrates tested.

II. *Effect of carbohydrate feeding on blood sugar*, M. R. Jones (pp. 507–519).—To determine the relation between sugar in the urine and that in the blood, the composition of these fluids in rabbits was determined after the ingestion of comparable doses of the various carbohydrates studied above. The comparisons were made on the basis of sucrose tolerance.

"Comparable doses of carbohydrates gave rise to hyperglycemia in the following order of increasing blood sugar values: Dextrin, dextri-maltose, and glucose.

"Sucrose ingested in doses sufficient to cause glycosuria presented three distinct phenomena: (1) Hypoglycemia with normal total blood sugar content accompanied by sucrosuria; (2) a relatively low glycemia with high total blood sugar value accompanied by both glycosuria and sucrosuria; (3) hyperglycemia accompanied by glycosuria.

"In the few determinations made, maximum blood sugar values were attained one hour after the ingestion of glucose and dextri-maltose, an increase in dose resulting, in general, in an increase in blood sugar content."

On chlorid metabolism, H. F. Host (*Jour. Lab. and Clin. Med.*, *5* (*1920*), *No. 11*, *pp. 713–729*, *figs. 7*).—This lecture, given at the University of Christiania, deals with normal and pathological chlorid metabolism. A list of 23 literature references is appended.

The vitamin requirements of the rat on diets rich in protein, carbohydrate, and fat, respectively, C. Funk and H. E. Dubin (*Science*, *n. ser.*, *52* (*1920*), *No. 1349*, *pp. 447*, *448*).—In an attempt to throw some light on the theory of the importance of proteins of high biological value on the etiology of pellagra and war edema, the authors have conducted feeding experiments on rats with diets containing large amounts (49 gm.) in turn of meat, sugar, starch, and lard, and small amounts (12 gm.) each of the other three materials, the diets also containing 3 gm. of salts, 4 cc. of autolyzed yeast, 3 cc. of orange juice, 3 gm. of agar, and 5 cc. of cod liver oil. In the case of the high sugar, starch, and lard diets extra vitamin (autolyzed yeast) was given to some of the rats after 25 days. The percentage gains in weight for all series during the first 25 days and the following 55 days are reported.

These data apparently indicate that in the high protein diet no extra vitamin was required, the total percentage increase in weight being 129 as against 70 for the sugar, 68 for the starch, and −17 for the lard diets. The total percentage gains for the animals which received extra vitamins for the last 55 days are given as 160, 170, and 25 for the sugar, starch, and lard diets, respectively. It is stated that the replacement of part of the lard by butter caused no improvement in growth.

"The findings reported here show conclusively that, although the qualitative food requirements of a well-balanced diet have been pretty well established, this can not be said of the quantitative relationship between the dietary constituents necessary for proper nutrition. It is quite conceivable that, under the abnormal conditions existing during the war period and after, the usual ratio between the protein, carbohydrate, and vitamin constituents have been so changed as to present conditions analogous to those described by us in rats."

On glandular adipose tissue, and its relation to other endocrine organs and to the vitamin problem, W. Cramer (*Brit. Jour. Expt. Path.*, *1* (*1920*), *No. 4*, *pp. 184–196*, *pls. 2*, *fig. 1*).—Attention is called to the fact that in all types of mammals there exists in different parts of the body a glandular type of adipose tissue histogenetically distinct from the ordinary adipose tissues. In the embryo of all species this tissue has a characteristic gland-like structure. In some species (rat, mouse, and hibernating animal) this structure is retained, but in most species the tissue acquires the appearance of ordinary adipose

tissue soon after birth. It is, however, functionally distinct from ordinary adipose tissue, as its fat is rich in cholesterin compounds and other lipoids in addition to ordinary true fat. Under conditions which bring about the disappearance of the ordinary adipose tissue the lipoid in this tissue is retained, as is the lipoid in the adrenal cortex. If vitamins are completely withheld from the diet the lipoids disappear from the adrenal cortex and from this glandular tissue.

"Since the death of an animal on a vitamin-free diet coincides with an exhaustion of the contents of the gland, the conclusion seems obvious that the gland is itself rich in at least one of the vitamins and supplies the animal with it when the external supply is cut off. Experiments, which are at present in progress to test this point, appear to confirm this conclusion with reference to the fat-soluble accessory food substance. These observations raise a question of general importance in connection with the etiology of the deficiency diseases, for they suggest that disturbances of the functional activity of this gland may constitute an important factor in eliciting the disease."

The author suggests that this glandular type of adipose tissue be called the lipoid gland or the cholesterin gland.

Vitamins and lipoid metabolism, W. CRAMER (*Jour. Physiol., 54 (1920), No. 1-2, pp. II-IV*).—A brief note in regard to the theory noted above.

The influence of overcooking vegetables in causing scurvy among children, H. CHICK and E. J. DALYELL (*Brit. Med. Jour., 3119 (1920), pp. 546-548*).—An outbreak of scurvy occurring in April, 1919, among the 64 children under treatment for tuberculosis at the University Kinderklinik, Vienna, was traced to the overcooking of the fresh vegetables which were included in the diet. These vegetables, which should have provided ample antiscorbutic material, were subjected, according to the Viennese custom, to two separate cooking processes, a slow boiling followed by a second heating with a flour and fat sauce. Suggestions are given for slight modifications in this method of cooking vegetables which would prevent much loss of antiscorbutic material and yet not alter to any great extent the present manner of preparing the food. The germination of dry beans, peas, and lentils before cooking is also recommended as a means of providing extra antiscorbutic material when fresh vegetables and fruit are scarce.

The development of scurvy in some of the children who had been in the hospital less than three months, together with the fact that there was no outbreak of the disease in the general population of the city, has led to the suggestion that the abnormally rapid growth of the children when first placed upon the ample diet of the hospital perhaps promoted the development of scurvy.

A contribution to the pathology of pellagra, H. E. ROAF (*Jour. Roy. Army Med. Corps, 34 (1920), No. 6, pp. 534-538*).—Determinations on autopsy of the weight of the adrenals in 14 cases of uncomplicated pellagra and 12 cases of other wasting diseases, and histological studies of the adrenals and of the sympathetic nervous system in a few of these cases, showed that the adrenals were somewhat lighter in pellagra than in other wasting diseases and appeared abnormal, while still more marked histological changes occurred in the sympathetic nervous system, the most striking effect being plasmolysis of the ganglion cells. "It seems as if the Turkish prisoners of war had suffered from such nutritional changes that their adrenals were defective in activity, and that in those who had additional strain thrown upon them the sympathetic nervous system became exhausted with the production of the symptoms of pellagra."

Observations on the relation between emotional and metabolic stability, F. S. HAMMETT (*Amer. Jour. Physiol., 53 (1920), No. 2, pp. 307–311*).—From the chemical analyses of the blood of emotionally stable or unstable insane and normal persons, the author has calculated the coefficient of variability for each blood constituent determined for each individual and taken the sum of these coefficients as the total variability of the intermediary metabolism of the person in question. While the differences in variability of one individual from the next were small, there was a marked difference between those of highest and lowest metabolic instability which corresponded with emotional instability and stability, respectively.

"This relation between a relatively high metabolic stability and a low grade of emotional reaction, and between a relatively low metabolic stability and a condition of temperamental excitability, is by no means claimed to be exact or quantitative. Nevertheless, the data seem to indicate such a tendency. The logical conclusion to be drawn from this comparison is that larger variations in intermediary metabolism are prone to accompany conditions of ready emotional response of a marked nature to disturbing stimulation, and that on the other hand the variability of the intermediary metabolism in individuals who are less susceptible is liable to be relatively low."

ANIMAL PRODUCTION.

Structural characteristics of the hair of mammals, L. A. HAUSMAN (*Amer. Nat., 54 (1920), No. 635, pp. 496–523, figs. 199*).—The author outlines a classification of hair structure based upon the diameter of the hair, the condition of the medulla, and the shape of the cuticular scales. The methods of preparing hair samples for microscopic examination are described, and figures illustrate the hair structure of 166 species of mammals. These illustrations are not in general duplicated in the papers noted below.

Hairs that make fabrics.—The microscopic identification of mammal hairs used in the textile industry, L. A. HAUSMAN (*Sci. Amer., 122 (1920), No. 8, pp. 184, 200, 202, figs. 23*).—Illustrations of the structure of the hair in the sheep, goat, camel, alpaca, guanaco, vicuña, and some other mammals are presented.

The microscopic identification of commercial fur hairs, L. A. HAUSMAN (*Sci. Mo., 10 (1920), No. 1, pp. 70–78, figs. 27*).—The author gives illustrations showing the hair structure in fur-bearing mammals, with notes on the market practice of misnaming furs.

Studies on the gonads of the fowl.—I, Hematopoietic processes in the gonads of embryos and mature birds, J. F. NONIDEZ (*Amer. Jour. Anat., 28 (1920), No. 1, pp. 81–107, pls. 3*).—The author has made a histological study of the gonads in embryos and adults of different breeds, particularly the testes of Sebright bantams (hen feathered) and Rhode Island Reds (cock feathered), in order to establish definitely the origin and nature of the cells interpreted as interstitial cells by various authors.

The granule-laden cells described in the adult as true interstitial cells by Boring and Pearl (E. S. R., 39, p. 177) were found to be derived from large lymphocytes produced by a differentiation of the mesenchyme cells. Similar cells were found elsewhere in the general body mesenchyme and it is held that they have no secretory function. They are mostly destroyed by phagocytosis, but their persistence in the adult stage has been observed by Goodale (E. S. R.,

42, p. 668). The connective tissue cells described by Boring (E. S. R., 27, p. 869) were found to be small lymphocytes produced in the gonads. These later give rise to large wandering cells, which, after storing fat in their cytoplasm, resemble the so-called Leydig cells and interstitial cells. Because of their irregular presence they are thought not to have any endocrine function.

It is concluded that the secondary sexual characters of the mature cock-feathered male are not induced by a specific interstitial secretion.

Secondary sexual characteristics and endocrinology, A. PÉZARD (*Endocrinology, 4 (1920), No. 4, pp. 527–540, figs. 2*).—The author discusses the secondary sexual characters of poultry in the light of the castration experiments which he has reported (E. S. R., 40, p. 871) and the work of other investigators. The testis in poultry is considered a typical endocrine organ in that it conforms to the law of continuity, the law of minimum efficiency, and the all-or-none law.

The origin and evolution of the interstitial cells and of the ovary and the significance of the different internal secretions of the ovary, I. OCHOTERENA and E. RAMIREZ (*Endocrinology, 4 (1920), No. 4, pp. 541–546, pl. 1, figs. 4*).—The authors report observations on the cyclic changes in the histological appearances of the ovaries in rabbits and refers to observations on other mammals. The interstitial cells just before rutting were found filled with mitochondria and at the height of their secretory activity. The resulting congestion in the ovarian interstitial tissue is held to favor the maturation of the Graafian follicle. The corpus luteum secretion is considered antagonistic to the interstitial secretion, and the rupture of the Graafian follicle, on this view, depresses the activity of the interstitial cells and thus causes the end of the period of heat.

The internal secretion of the testis, A. C. MASSAGLIA (*Endocrinology, 4 (1920), No. 4, pp. 547–566, figs. 5*).—Experiments with male fowls are reported in which atrophy of the testes was induced by the ligature and resection of the ductus deferens. The atrophy was confined to the seminiferous tubules and the spermatozoa; the Leydig cells in the interstitial connective tissue remained normal and elaborated fatty granules and mitochondria. These cocks retained their normal comb size, voice, and sexual instincts, and it was not until the removal of the atrophic testes that they assumed the usual traits and appearance of capons. The author thus concludes that it is the removal of the Leydig cells which causes the testicular change following castration.

The pituitaries (hypophyses cerebri) of these and other birds were moved and weighed at autopsy. Castration was found to produce a noticeable hypertrophy of the pituitary and an increase in the eosinophile leucocytes. The experimentally induced atrophy of the testes did not cause the pituitaries to undergo the changes characteristic of castration, and it is concluded that the hypophyseal changes are likewise due to the loss of the secretion of the Leydig cells.

The endocrine secretion of hen-feathered fowls, T. H. MORGAN (*Endocrinology, 4 (1920), No. 3, pp. 381–385, figs. 5*).—This is a general review of some of the author's experiments. The lutear cells in sections of the ovaries of ordinary hens and in the testes of hen-feathered Sebrights and Campines are illustrated.

The effects of castration on hen-feathered Campines, T. H. MORGAN (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 39 (1920), No. 4, pp. 231–247, figs. 16*).—Two hen-feathered Campine cockerels (of a strain known to be homozygous for hen feathering) were castrated at the age of 3½ months and shortly afterwards

developed typical cock feathering. The barred feathers of the saddle and wing-bow were replaced by feathers that were mainly white with a black base, a condition that was apparently typical of the cock-feathered individuals of the strain used.

A third cockerel of the same stock showed indications of cock feathering when young and this became more marked with age, but the comb remained small. A laparotomy was performed at the age of 6 months, and it was found that the testes had not developed beyond the juvenile stage. The testes were removed at the time, and the bird subsequently developed typical cock feathering.

The pituitary body (hypophysis cerebri) examined in these three capons at autopsy appeared slightly larger than in the single control examined. In the testes, examined histologically by J. F. Nonidez, lutear cells occurred in the two typical individuals, similar in all essentials to the lutear cells previously reported in the testes of hen-feathered Sebright bantam males and the ovaries of ordinary hens. In the aberrant individual lutear cells, although abundant, seemed to be undergoing degeneration.

Some breeding experiments by E. L. Jones[2] are cited which indicate that hen feathering in Campines is inherited substantially like hen feathering in Sebright bantams.

The effects of ligating the testes of hen-feathered cocks, T. H. MORGAN (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 39 (1920), No. 4, pp. 248–256, figs. 11*).— Experiments with four adult hen-feathered cocks indicated that it is possible to cause the complete degeneration and ultimate absorption of the testes by ligature of the spermatic artery. This form of castration is preferred for adults so as avoid the loss of valuable birds from the hemorrhage attending the direct ablation of the testes.

In one case where the testes entirely disappeared the cock became completely cock-feathered. Through faulty technique pieces of the testes remained functional in the other individuals. They became partly cock-feathered, but the comb remained full size.

Castration through the feed in cocks subjected to an exclusive meat diet, A. PÉZARD (*Compt. Rend. Acad. Sci. [Paris], 169 (1919), No. 24, pp. 1177–1179*).— The authors calls attention to the feeding experiments of Houssay (E. S. R., 20, p. 372). The autopsy records show that in 9 of the 14 cocks restricted to a meat diet the testes were very small in size. In cases where the reduction was extreme the cocks are known to have lost their fighting instincts and to have shown decrease in the size of comb. It is suggested that meat feeding produces a slow intoxication to which the germ gland is particularly susceptible.

On the left-sided incidence of the supernumerary digit in heterodactylous fowls, C. J. BOND (*Jour. Genetics, 10 (1920), No. 1, pp. 87–91*).—Among the 402 offspring of crosses between 4-toed and 5-toed breeds of poultry, there were 38 individuals with 5 toes on one leg and 4 on the other—a condition termed heterodactyly by the author. All but 4 of the heterodactylous fowls had the extra toe on the left side, and in symmetrical 5-toed birds there was observed a tendency for a stronger development of the extra digit on the left leg. Similar cases are cited from the literature and from unpublished data of Bateson and Punnett, and it is suggested that "the factor transmitted when a 5-toed is crossed with a 4-toed breed is a tendency to extra serial segmentation of the rudiments forming the digits and not a tendency to develop a fixed number of (5) digits." It is also recorded that cross-bred fantail pigeons have more feathers on the left side than on the right.

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[2] Farm Poultry, 25 (1914), No. 6, p. 113.

The genetic factor for hen feathering in the Sebright bantam, T. H. MORGAN (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 39 (1920), No. 4, pp. 257–259*).—Back crosses on Game bantam hens of F_1 hen-feathered cocks of the Sebright bantam×Game bantam cross have given a total of 7 hen-feathered and 10 cock-feathered males. These two classes are considered substantially equal and this, taken in connection with the F_2 data already reported (E. S. R., 42, p. 466), is held to favor the view that there are one and not two factor differences between the normal cock feathering and the Sebright type of hen feathering.

Note on a case of linkage in Paratettix, J. B. S. HALDANE (*Jour. Genetics, 10 (1920), No. 1, pp. 47–51*).—The author has examined the breeding data of Nabours (E. S. R., 40, p. 367), and concludes that in the grouse locust (*P. texanus*) the factor for melanic pattern is linked with the other group of factors, the crossover percentage being about 24 in the male and 46 in the female.

Commercial feeding stuffs, 1919–20, C. D. WOODS (*Maine Sta. Off. Insp. 96 (1920), pp. 29–64*).—This is the annual report on the registration and official inspection of feeding stuffs sold in Maine. Instead of analytical results, statements are given for each sample as to whether it conforms to guaranty.

Beef cattle investigations for the year 1919–20, C. W. MCCAMPBELL (*Kansas Sta., Fort Hays Substa. [Pamphlet], 1920, pp. 8, fig. 1*).—This publication was designed for distribution during the cattlemen's "round up" at the Fort Hays Substation in April, 1920, and consists mainly of tabular summaries of the results obtained from experiments in which 14 lots of beef cows or heifer calves were used, including 4 lots of 20 cows in the heifer-development project. This project, which had then extended over 5 winters, was giving definite results, and indicated that heifers bred to calve at the age of 2 years produced somewhat smaller calves than cows dropping their first calf at 3 years of age even when their winter rations before maturity included a liberal supply of grain.

Two new experiments dealt with the use of kafir and cane as a dry roughage and as a silage crop. The kafir results are summarized in the following table:

Comparison of kafir roughages in a 90-day feeding trial with young beef heifers.

Kind of kafir roughage fed.	Daily ration.			Initial weight per head.	Daily gain per head.	Kafir consumed per pound of gain.	Gain per acre of kafir.	Relative cost of gain.
	Kafir roughage.	Cottonseed cake.	Straw.					
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
Silage, heads included..	30.0	2	5.35	614	1.66	18.12	635.7	159
Silage, without heads..	30.0	2	3.50	629	1.06	28.38	285.0	100
Fodder, heads included.	27.1	2	3.92	602	1.33	20.42	246.0	548
Stover, without heads..	25.4	2	6.43	623	1.02	21.91	129.5	116

The relative costs were determined by assuming a relationship between the value of the stover and the value of the head, such that the stover was worth $6 a ton when the price of the grain was $1.50 a bushel.

The comparison between cane fodder and cane silage was made with mature cows and indicated that 1 ton of the fodder was equivalent in feeding value to 1.2 tons of silage, but it is estimated that about twice as much forage can be secured from the cane as a silage crop than as a fodder crop. These cows received 2 lbs. of cottonseed or linseed cake per day, but another lot received the same ration of cane silage (30 lbs.) with 7.66 lbs. of alfalfa hay in place of the oil cake. From the relative gains it is concluded that 3.5 lbs. of alfalfa

hay is about equal in feeding value to a pound of the cake as a supplement to silage for mature animals.

In a study of the methods of wintering heifer calves, it was found that a group kept in a small dry corral gained more rapidly than those given access to a large area of pasture. The success with the former method is attributed to the fact that the corral remained dry during the 90 days of the test.

Pea straw for fattening beef cattle, H. Hackedorn and J. Sotola (*Washington Sta. Bul. 157 (1920), pp. 24, figs. 7*).—This bulletin consists of a study of the digestibility of pea straw and the full report of a feeding experiment previously noted from a preliminary paper (E. S. R., 43, p. 870). Analyses of the pea straw, corn silage, alfalfa hay, ground barley, and cottonseed meal used in the feeding test are included.

A 10-day digestion trial was made with 2 steers which had been fed pea straw exclusively for 32 days previously. The pea straw (average of 20 analyses) contained 6.05 per cent crude protein, 1.57 per cent ether extract, 33.24 per cent crude fiber, 44.03 per cent nitrogen-free extract, and 5.32 per cent ash. The average coefficients of digestibility were as follows: Dry matter 59.3, organic matter 61.5, crude protein 58.4, ether extract 47.8, crude fiber 55.8, and nitrogen-free extract 67.2.

Soy bean hay is a good feed for ewes (*Iowa Sta. Rpt. 1919, p. 19*).—Experiments in the wintering of pregnant ewes completed in the spring of 1919 are held to indicate that soy bean hay is somewhat better pound for pound, than alfalfa hay when corn and silage are fed in addition.

Fattening lambs: Shelter v. open lot, R. Withycombe and E. L. Potter (*Oregon Sta. Bul. 175 (1920), pp. 11, figs. 3*).—The authors present the results of three tests made at the Eastern Oregon Substation in each of which one group of lambs was fattened during the winter in an open lot while a second group was provided with a rough shelter consisting of a low shed closed on two sides. The lambs received alfalfa hay ad libitum and a limited grain ration (oats and barley).

The sheltered lot made slightly better gains in each case, the average being 0.30 lb. per head per day, whereas the average gain in the case of the unsheltered group was 0.29 lb. The sheltered lambs consumed 9.1 lbs. of hay and 2.8 lbs. of grain per pound of gain while the unsheltered lambs required 9.4 lbs. of hay and 2.9 lbs. of grain.

Suggestions for the management of fattening lambs and estimates of feed costs are appended.

Farm slaughtering and use of lamb and mutton, C. G. Potts (*U. S. Dept. Agr., Farmers' Bul. 1172 (1920), pp. 32, figs. 31*).—This publication gives directions for the slaughtering of sheep and the cutting up of the carcasses, and is illustrated by a number of clear halftones. There are also suggestions for the home curing of mutton, discussion of the use of mutton in the diet, and recipes for cooking mutton and lamb, previously noted (E. S. R., 29, p. 159).

The use of forage crops in the fattening of pigs, W. L. Robison (*Ohio Sta. Bul. 343 (1920), pp. 165–222, figs. 31*).—The author reports 16 pasture experiments with young pigs and 1 with 200-lb. gilts conducted during the summers of 1912 to 1918. These experiments follow those reported in Bulletin 242 (E. S. R., 28, p. 468) and have not hitherto been published.

The experiments deal chiefly with the methods of feeding supplements to pigs on pasture, and in the most of them one or more groups of pigs were fed in the dry lot to provide data as to the gains attributable to the pasturage and the

saving in feed by the pasture crops. The following table summarizes the experiments with red clover pasture:

Comparison of methods of feeding corn and tankage to pigs on red clover pasture.

Experiment.	Method of feeding corn and tankage.	Ratio, corn to tankage.	Ration per 100 lbs. weight.	Initial weight per head.	Length of test.	Daily gain per head.	Consumed per pound of gain.		Gain accredited to an acre.
							Corn.	Tankage.	
			Pounds.	*Pounds.*	*Weeks.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	No tankage, full feed of corn	....	3.67	34.4	18	0.80	3.88	....	55
	Free choice	10:1	3.89	34.2	18	1.32	3.15	0.30	110
	Full feed, hand fed	19:1	3.79	34.9	18	1.28	3.25	.17	519
	Three-quarters of a full feed	19:1	3.39	34.3	18	1.01	3.13	.16	431
	Do 12 weeks; full feed 6 weeks	19:1	3.54	34.5	18	1.14	3.14	.17	537
2	No tankage, full feed of corn	....	4.16	43.8	18	1.16	4.18	....	41
	Free choice	23.1	4.28	42.6	18	1.40	3.84	.16	119
	Full feed	19.1	4.45	43.5	18	1.47	3.89	.20	—8
[1] 3	Full feed, hand fed	15 1	4.19	48.4	12	1.03	3.48	.21	374
	3 per cent ration	15·1	2 93	48.1	12	.62	3.28	.22	220
	2 per cent ration	16:1	1.93	48.3	12	.50	2.51	.16	242

[1] In experiment 3 the proportion of corn in the rations was progressively increased.

As part of experiment 1 a plat of blue grass with a little white clover was also pastured, corn and tankage being given free choice. The average daily gain was 1.43 lbs. per head, and 3.15 lbs. of corn and 0.26 lb. of tankage were required per pound of gain. Corn and tankage were consumed in the proportion 12.1 and 191 lbs. of gain are attributed to an acre of pasture.

Certain of the experiments with rape pasture are included in the following table:

Comparison of methods of feeding corn and tankage to pigs on rape pasture.

Experiment.	Method of feeding corn and tankage.	Ratio, corn to tankage.	Ration per 100 lbs. weight.	Initial weight per head.	Length of test.	Daily gain per head.	Consumed per pound of gain.		Gain accredited to an acre.
							Corn.	Tankage.	
			Pounds.	*Pounds*	*Weeks.*	*Pounds*	*Pounds.*	*Pounds.*	*Pounds.*
4	Limited corn, no tankage	....	3.30	51.0	12	0 88	3.29	....	268
	Four-fifths of full feed	9:1	3.60	52.1	12	1.18	2.79	0.31	357
5	Full feed	14:1	4.21	39.9	15	1.26	3.30	.21	(1)
	2 per cent ration; later full feed	14:1	3.30	40.6	15	1.12	2 73	.19	(1)
6	3 per cent ration throughout	14:1	2.88	52.1	15	1.08	2.70	.19	(1)
	2 per cent ration; later full feed	14:1	3.09	52.3	15	1.22	2.75	.20	(1)
8	Full feed of corn; no tankage	....	4.11	35.3	18	.88	4.23	....	366
	Increasing feed of corn; no tankage	....	3.09	34.8	18	.63	3.66	....	339
	Full feed	19:1	3.89	36.4	18	1 06	3.61	.19	625
	2 per cent ration, later full feed	19:1	3.13	35.2	18	.85	3 10	.16	441
	Full feed	9:1	4.01	35.1	18	1.10	3.42	.38	430
	2 per cent ration; later full feed	9:1	2.90	35.0	18	.95	2.60	.29	117

[1] Not computed, as no check groups were fed in the dry lot.

Three experiments (numbered 11, 12, and 13) involving, respectively, 100-lb., 80-lb., and 70-lb. pigs, were studies of hand feeding of supplements *v.* self-

feeding by the free choice system. The supplements in each case were corn and tankage and the pasture was rape. In each experiment the self-fed pigs gained more rapidly than the hand-fed ones, but in the case of the two experiments with younger pigs the hand feeding produced more economical gains.

One experiment (numbered 10) was a comparison between a full feed of corn without supplement and the self-feeding of corn and tankage, free choice, the pasture being rape. The self-feeding method produced the more rapid and more economical gains.

Experiment 7 was a comparison between full and limited feeding on rape pasture, the supplements during the first 4 weeks of the test being middlings and tankage (14:1), with hominy feed substituted for middlings during the last 17 weeks. The lot full fed throughout made an average daily gain of 1.26 lbs. per head; the lot starting on a 2 per cent ration and gradually increased to a full feed made a daily gain of 1.07 lbs.; the lot starting on a 1 per cent ration and gradually increased to 3 per cent gained 0.72 lb.; and the lot continued on a 1 per cent ration throughout gained 0.43 lb. per day. The control pigs full fed in dry lot gained 1.03 lbs. The lighter rations were more economical of feed but lowered the dressing weight.

Methods of feeding supplements on soy bean pasture were studied in experiment 9. The lot given a full feed of corn without tankage made an average daily gain of 1.03 lbs. and the lot fed a ⅔ feed of corn gained 1.02 lbs. The former required 2.79 and the latter 2.25 lbs. of corn per pound of gain. The lot given a full feed of corn and tankage (9:1) made a daily gain of 1.18 lbs. and consumed 2.52 lbs. of feed per pound of gain. The lot given a ⅔ feed of corn and tankage (9:1) made a daily gain of 1 lb. and required 2.36 lbs. of feed per pound of gain.

Experiments 14, 15, and 16 were comparisons of the following mixed pasturages: (1) Canada field peas and oats, (2) field peas and rape, (3) rape and oats, and (4) rape and soy beans. In each case there was a check lot on rape alone, and it was found that the rape furnished pasture for a much longer period than any of the mixed forage crops tested. Experiment 17 was a comparison between sweet clover pasture and soy bean pasture in which it was found that the sweet clover was distinctly distasteful to the pigs.

The author includes a table showing the influence of weight of pig on the amounts and proportions of corn and tankage consumed when fed free choice, and also presents estimates of the amounts of corn replaced by tankage in the dry lot and on the several pasture crops tested.

Study of some poultry feed mixtures with reference to their potential acidity and their potential alkalinity, I, B. F. Kaupp and J. E. Ivey (*Jour. Agr. Research* [*U. S.*], *20* (*1920*), *No. 2, pp. 141–149*).—This contribution from the North Carolina Experiment Station has been noted from another source (E. S. R., 43, p. 573).

Selection and preparation of fowls for exhibition, J. W. Kinghorne (*U. S. Dept. Agr., Farmers' Bul. 1115* (*1920*), *pp. 3–10, figs. 7*).—Designed for the use of members of boys' and girls' poultry clubs.

DAIRY FARMING—DAIRYING.

The reaction of milk in relation to the presence of blood cells and of specific bacterial infections of the udder, J. C. Baker and R. S. Breed (*New York State Sta. Tech. Bul. 80* (*1920*), *pp. 3–19*).—Essentially noted from another source (E. S. R., 43, p. 578).

Unit requirements for producing milk in western Washington, J. B. Bain and G. E. Braun (*U. S. Dept. Agr. Bul. 919* (*1920*), *pp. 19*).—This is a study of

the cost of producing milk in Skagit County, Wash., about 70 miles north of Seattle. It was conducted according to the plan used for previously published studies in North Carolina and Indiana (E. S. R., 43, p. 678).

The first year of the study began in August, 1917, and covered 17 herds. The second year began in January, 1919, and covered 18 herds. The average herd consisted of 31.3 cows in 1917–18 and 28.6 cows in 1919, and the yearly production per cow averaged 7,833 lbs. of milk, testing 3.66 per cent fat. The cows were mainly Holsteins, and the milk was mostly sold for condensing purposes, delivery being by motor truck. The following table summarizes the average feed and labor requirements for the two years:

Miscellaneous expenditures and amounts of feed and labor required for milk production in Skagit County, Wash.

Basis of computation and season.	Mill feed.	Home-grown grain.	Legume hay.	Other hay.	Stover and fodder.	Silage, etc.	Human labor.	Horse labor.	Bedding	Pasture.	Miscellaneous costs.[1]
Per cow	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Hrs.*	*Hrs.*	*Lbs.*	*Acres.*	
November to April..	711	235	246	2,558	186	4,610	60.1	0.29	289	0.1	$15.70
May to October......	214	27	28	314	4	1,864	60.9	.67	6	1.0	16.02
Entire year..........	925	262	274	2,872	190	6,474	121.0	.96	295	1.1	31.72
Per 100 lbs. milk:											
November to April..	22.1	7.3	7.6	79.5	5.8	143.3	1.9	.01	9.0	....	.50
May to October......	4.6	.6	.6	6.8	.1	40.4	1.3	.02	.1	.025	.36

[1] Excluding changes in inventory values of cows.

There were 115 lbs. of manure saved in the winter per 100 lbs. of milk and 13 lbs. saved in the summer. Three per cent of the cows did not calve within the year, 55 per cent freshened in the winter, and 42 per cent in the summer.

Feed and bedding totaled 43.9 per cent of the gross costs (including depreciation), pasture 12.5 per cent, labor 23.5 per cent, and miscellaneous charges 17.6 per cent. Depreciation of stock formed 2.5 per cent of the gross costs. This was 4.4 per cent of the capital value of the cattle and would have been larger except that a number of cows were sold at good prices for dairy purposes in 1919.

Hired men, often professional milkers, performed 64.2 per cent of the work in the winter and 59.2 per cent in the summer. Women and boys did 10.2 per cent of the winter work and 13.8 per cent of the summer work.

To keep a bull one year required 630 lbs. of grain, 5,967 lbs. of dry roughage, 3,069 lbs. of succulent roughage, 43 lbs. of bedding, and 40.4 hours of human labor, besides pasture costs and miscellaneous charges.

Buying and selling milk on a butter-fat basis (*New Jersey Stas. Circ. 121 (1920), pp. 24, figs. 4*).—This contains the text of the New Jersey dairy inspection law of 1920 regulating the testing of milk and cream sold on the fat basis, together with rules for the licensing of testers and the results of the inspection of Babcock test bottles and pipettes.

Cheesemakers save by figuring costs, J. L. Sammis and O. A. Juve (*Wisconsin Sta. Bul. 321 (1920), pp. 21*).—The authors present an outline of an accounting system for cheese factories and report on the operating cost during 1918 of 18 Wisconsin factories, this being the number of complete replies to a questionnaire sent out by the station.

The factories fell into two well-marked groups of equal size on the basis of the amount of labor income. In one group (designated A) the labor income ranged from $1,383 to $3,472 with an average of $2,069. The highest labor income in the second group (B) was $704 and the average was $237, there being

2 factories with negative income. The daily output in group A ranged from 827 to 375 lbs. with an average of 562. In group B, production ranged from 427 to 195 lbs. with an average of 298. In group A, the cost per pound of cheese was 2.686 cts., of which 0.221 ct. was building and land charges, 0.205 ct. equipment charge, and 1.26 cts. supplies, help, taxes, etc., with the cheesemaker's wage (at $2,000 per annum) forming the balance. In group B, the total cost was 3.879 cts. per pound of cheese, of which 0.442 ct. was charged to building and land, 0.347 ct. to equipment, 1.34 cts. to supplies, help, and taxes, and the balance to the maker's pay.

VETERINARY MEDICINE.

Treatise on immunity in infectious diseases, J. Bordet (*Traité de l'Immunité dans les Maladies Infectieuses. Paris: Masson & Co., 1920, pp. VIII+720; rev. in Brit. Med. Jour., No. 3109 (1920), p. 167*).—As stated in the author's preface, the object of this treatise has been to contribute to the popularization of the fundamental ideas of immunity. With this in mind, the first of the four parts into which the book is divided consists of a general survey of the field of infection and immunity and of the problems confronting the bacteriologist and physiologist engaged in the study of immunity. Part 2 deals with cellular immunity under the headings of intracellular digestion, inflammation and phagocytosis, the conflict between phagocytes and bacteria, and factors assisting phagocytosis. Part 3, on humoral immunity, deals with the principal functions of immune serums, a comparison of immune with normal serum, alexin and its fixation, antigens and antibodies, their reactions and specificity, and anaphylaxis and the ferments of the blood. In part 4, on the reaction of the organism as a whole, the practical applications of modern theories of immunity are discussed with applications to different diseases.

Technique of vaccines and curative sera, A. Marxer (*Technik der Impfstoffe und Heilsera. Brunswick, Germany: Friedr. Vieweg & Son, 1915, pp. IX+319*).—This book consists of a concise compilation of material on vaccines and sera for human and animal diseases, with many references to the original literature. Chapters are included on the theoretical aspects of immunity, the principles employed in the preparation of antigens and antibody-containing sera and their properties, and serum sickness (anaphylaxis, allergy, etc.).

Textbook of toxicology for veterinarians, E. Fröhner (*Lehrbuch der Toxikologie für Tierärzte. Stuttgart: Ferdinand Enke, 1919, 4. rev. ed., pp. VIII+416*).—This is a revised edition of the work previously noted (E. S. R., 24, p. 778).

Meat and food inspection, W. Robertson (*London: Baillière, Tindall & Cox, 1920, 2. ed., pp. XIV+292, figs. 49*).—The several chapters of this work, the first edition of which has been previously noted (E. S. R., 20, p. 565), relate, respectively, to the sites, structure, and various types of cowsheds, piggeries, and stables; some facts concerning milk supplies, tuberculin and mallein tests—preparation of vaccine lymph; slaughterhouses, general considerations; the appearances of healthy and diseased animals; anatomical considerations; methods of slaughter; the appearance of the meat of animals under varying conditions; preservation and storage of meat; the diseases most commonly seen in the abattoir; other conditions met at the slaughterhouse; fish, oysters, mussels; ptomaine and food poisoning; food shops, farm and poultry produce; and prosecutions, various examples. The text of legal enactments relating to the subject in the United Kingdom is appended.

Report on the veterinary service of Saxony, 1912, 1913, 1914, 1915, 1916, 1917, and 1918 (*Ber. Veterinärw. Königr. Sachsen, 57 (1912), pp. V+228, figs. 2; 58 (1913), pp. V+224; 59 (1914), pp. V+194; 60 (1915), pp. V+187; 61 (1916), pp. V+220; 62 (1917), pp. V+244; 63 (1918), pp. V+232*).—These are annual reports (E. S. R., 28, p. 79) dealing with the occurrence of diseases of domestic animals, meat-inspection work, etc. Much of the data is presented in tabular form.

Reports on the civil veterinary department (including the Insein Veterinary School), Burma, for the years ended March 31, 1919, and March 31, 1920, G. H. Evans (*Burma Civ. Vet. Dept. Rpt., 1919, pp. 6+13, pl. 1; 1920, pp. 6+15, pl. 1*).—These are the usual annual reports (E. S. R., 42, p. 675).

Investigations of the germicidal value of some of the chlorin disinfectants, F. W. Tilley (*Jour. Agr. Research [U. S.], 20 (1920), No. 2, pp. 85–110*).—Investigations here reported, much of the data relating to which is presented in tabular form, led to the following conclusions:

"In the ordinary routine work of general disinfection, such as disinfection of cattle cars and pens, there is always a large amount of organic matter present. It is evident, therefore, that because of the enormous diminution in germicidal value on addition of organic matter as well as because of the injurious effects on metals and fabrics the chlorin disinfectants as a class do not seem to be suited for use under the usual conditions and by the usual methods of general disinfection. That is not to say, however, that when properly used they are not efficient and valuable in the treatment of infected wounds; in fact, the evidence available goes to show that they are of great value when so used; and, of course, chlorin and hypochlorites are being very widely and successfully used for the disinfection of drinking water.

"Compared on a basis of weight of chloramin T as against weight of chlorin as sodium hypochlorite (Dakin's solution) or hypochlorous acid (eusol), or as chlorin in aqueous solution, chloramin T is less efficient than the others. But if the comparison is made on the basis of available chlorin contained, it is much more efficient against *Staphylococcus aureus*, much less efficient against *Bacillus pyocyaneus*, and approximately equal in efficiency against *B. typhosus*.

"The experiments upon *B. tuberculosis* indicate that the chlorin disinfectants are worth very little so far as that organism is concerned. This is not surprising in view of the use of antiformin ($NaOCl+NaOH$) in isolating tubercle bacilli.

"In the present work, considered as a whole, there is seen throughout more or less 'selective action' on the part of the various disinfectants. The most clearly defined example of this is seen in the extremely high value of chloramin T against *S. aureus* as compared with its extremely low value against *B. pyocyaneus*.

"The results of the experiments upon anthrax spores show that the germicidal action of chlorin compounds is not always so speedy as is commonly supposed but may extend over several days.

"The addition of ammonia to solutions of chlorin or hypochlorites very greatly increases germicidal activity and tends to prevent depreciation in value on the addition of organic matter."

Anesthesia with stovaine in veterinary surgery and medicine, G. Pérol (*Anesthésie a la Stovaïne en Chirurgie et en Médecine Vétérinaire. Paris: Masson & Co., 1919, pp. 31, pls. 6*).—This deals with the use of stovaine in both local and regional anesthesia.

Use of the single cell method in obtaining pure cultures of anaerobes, M. A. BARBER (*Jour. Expt. Med., 32 (1920), No. 3, pp. 295–311, pl. 1*).—This is the report of an investigation of the applicability of the pipette method * to the isolation of anaerobes. The method, with slight modifications in technique which are described, has been found to be feasible for obtaining one-cell pure cultures of anaerobes. Both bacilli and spores may be used as seeding material, although spores give a higher percentage of positives. Semisolid agar is recommended as the most convenient form of medium, a sufficient degree of anaerobiosis being obtained by boiling alone.

Standardization of bacterial suspensions, W. E. KING (*North Amer. Vet., 1 (1920), No. 8, pp. 385, 386*).—This is a brief discussion of various methods which have been previously noted from the original sources.

Enhancement of the opsonizing and agglutinating powers of antipneumococcus serum by specific precipitating serum, I. W. PRITCHETT (*Jour. Expt. Med., 32 (1920), No. 3, pp. 283–293*).—On the basis of observations by various workers that it is possible to produce in animals, through the injection of certain immune or normal sera, antisera capable of inhibiting the action of antibodies, an investigation was undertaken to determine whether pneumococcus antiopsonins are formed in rabbits following the intravenous injection of monovalent pneumococcus horse sera, Types I, II, and III.

No evidence of the formation of pneumococcus antiopsonins could be obtained. On the contrary, the opsonizing and agglutinating properties of the immune horse sera were greatly enhanced in the presence of the Type I and Type II sera.

The increase in opsonization and agglutination is thought to depend upon specific sensitization of the pneumococci by the homologous immune serum and the presence of the precipitating serum. Preliminary sensitization of the bacteria before precipitation, or precipitation in the rabbit-horse serum mixture before the addition of the pneumococci, caused little if any difference in result from that obtained when the immune serum, precipitating serum, and pneumococci were mixed and incubated together.

A corresponding increase in protective power in vivo could not be obtained by the addition of the specific precipitating serum.

Epizootic lymphangitis of solipeds, a contribution to the study of mycosis, A. BOQUET and L. NÈGRE (*Lymphangite Épizootique des Solipèdes, Contribution a l'Étude des Mycoses. Paris: Masson & Co., 1920, pp. II+143, pls. 3; rev. in Jour. Compar. Path. and Ther., 33 (1920), No. 2, pp. 117–121*).—This work gives a complete account of the etiology, pathology, symptoms, diagnosis, treatment, etc., of epizootic lymphangitis. It records recent observations and discoveries of importance, many of them having been made by the authors. Bibliographies accompany the several chapters.

On the prevention of foot-and-mouth disease, H. M. LISBOA and A. A. DA ROCHA (*Mem. Inst. Oswaldo Cruz, 12 (1920), No. 1, pp. 66–72; trans., pp. 60–65*).—This paper is based upon observations by the authors in many foci of foot-and-mouth disease and experiments conducted over a period of six years. They find the average duration of immunity in animals after recovery to be about one year. It is believed that the divergence of opinion regarding this period is due to the varying intensity of infection and to the degree of individual resistance. When an animal has a slight attack it may be liable to another benign attack at the end of about six months, but this is very exceptional. The shortest period of immunity observed by the authors was four months,

* Philippine Jour. Sci., Sect. B, 9 (1914), No. 4, pp. 307–358.

which followed a very slight infection induced by experimental inoculation. The longest period of immunity observed was two years, which occurred after a virulent attack.

"The work was done in the following way: Aphthæ taken from a bull that had had a virulent attack of foot-and-mouth disease were crushed in a mortar and diluted in physiological solution; after that they were filtered, first through large-meshed tissue and afterwards through filtering paper. This took about an hour. The substance thus obtained was injected in the jugular vein of an ox that had hitherto proved refractory to aphthous fever. This was repeated four times, at intervals of seven days, and was done at night so as to prevent the virus from being spoilt by heat." The animal was bled 10 days after the last injection and the serum obtained was kept in 0.5 per cent carbolic solution. Laboratory work showed that 120 cc. protected adults, while 80 cc. was sufficient for calves over six months of age. Used on pigs, it proved to be preventive in doses of 40 cc. for adults and 20 cc. for sucking pigs.

Experiments with serum against foot-and-mouth disease, F. ROSENBUSCH (*An. Soc. Rural Argentina, 53 (1919), No. 21, pp. 1009–1016; abs. in Abs. Bact., 4 (1920), No. 3, p. 188*).—An account is given of the use of serum obtained from cattle artificially immunized against foot-and-mouth disease as a preventive measure at the National Livestock Exposition at Palermo in September, 1919.

The preventive doses for the Aberdeen-Angus and Dutch cattle varied between 40 and 80 cc. and those for the Shorthorn and Hereford between 80 and 100 cc. Reinjection at the end of the fifteenth day is recommended to prolong the resistance conferred by the first injection. As a result of the experience reported, the author is of the opinion that the serum injected in sufficient quantities is not only capable of preventing the disease but when given at the full development of the disease causes it to take a much milder form with less serious complications. Parturition is thought to lower the resistance conferred by the serum, and consequently reinoculation of the animal after labor is recommended.

Contribution to the growth of the glanders bacillus with special reference to mallein formation, H. VEHSE (*Monatsh. Prakt. Tierheilk., 31 (1920), No. 7–8, pp. 363–382*).—This article reports a study of the relative values of protein-free and of bouillon media for the growth of glanders bacilli for the mallein test, and of the effect of different factors upon the growth of the bacillus.

A protein-free nutritive medium consisting of 15 parts of monosodium phosphate, 20 of monopotassium phosphate, 3 of magnesium sulphate, 12.5 of magnesium citrate, 25 of asparagin, and 100 of glycerin made up to 5,000 parts with distilled water was found to be as satisfactory as one containing bouillon. The growth of the organism took place best in neutral or slightly acid media in the presence of between 4 and 5 per cent of glycerin. Sucrose hindered and lactose favored the growth of the organism. Of the colored media litmus lactose agar gave good results, while neutral red agar afforded only scanty growth.

Glanders diagnosis in slaughtered animals, the valuation of the flesh, and the utilization of the hides of glandered animals, C. GIESE (*Ztschr. Fleisch u. Milchhyg., 30 (1920), Nos. 14. pp. 185, 186; 15, pp. 197–199*).—This is a summary of information on the rules in Germany governing the use of the hides and meat of glandered animals.

Tuberculosis eradication under the accredited-herd plan.—Herd list No. 3 (*U. S. Dept. Agr., Dept. Circ. 142 (1920), pp. 52*).—This third herd list (E. S. R., 42, p. 380) shows herds of all breeds officially accredited as free from tuberculosis on June 30, 1920. Several summary lists are also included. The largest number of accredited herds was in Minnesota, followed by Virginia,

Wisconsin, Pennsylvania, the District of Columbia, etc. There are shown to be 3,370 accredited herds and 16,599 herds once tested without reactors.

Tuberculosis eradication under the accredited-herd plan.—Supplements 1 and 2 to herd list No. 3 (*U. S. Dept. Agr., Dept. Circs. 143 (1920), pp. 98; 144, pp. 49*).—The first supplement consists of a list of herds of Ayrshire, Guernsey, Holstein-Friesian, and Jersey cattle, the second of a list of herds of Aberdeen Angus, Brown Swiss, Devon, Dutch Belted, Galloway, Hereford, Red Polled, and Shorthorn, all of which have passed one official tuberculin test with a view to being accredited. The breeds of cattle, the names of owners, and the States in which the herds are located are arranged in alphabetical order.

A study of goiter and associated conditions in domestic animals, J. W. KALKUS (*Washington Sta. Bul. 156 (1920), pp. 48, pls. 10*).—This is a report of studies made of goiter in domestic animals in Washington, with the results obtained in experimental work.

Present knowledge indicates that the affection is most frequently found east of the Cascade Mountains along the valleys of the Wenatchee, Entiat, and Methow Rivers, and on the banks of Lake Chelan, all of which are mountainous regions. The nature of the disease as it has appeared in horses, cattle, hogs, sheep, goats, and other animals is considered at some length. A microscopic study of the thyroid, next discussed, revealed that all species of affected newborn animals have the so-called hyperplastic goiter. A discussion of the cause, of the iodin content of foodstuffs, and of the thyroid glands, and the details of experimental work with animals follows. The summary drawn by the author is as follows:

"Hyperplastics goiter is enzootic among all species of domestic animals in certain so-called goitrous regions. It is especially prevalent in certain sections of Washington, Montana, and British Columbia. The disease is manifested in somewhat different forms in the different species of domestic animals, but the primary lesion in all cases is of similar character and consists of hyperplasia of the thyroid. This type of goiter is of little importance in the adult, but causes grave disturbances in the newborn. Affected colts, kids, lambs, and pigs seldom live, while the condition is less fatal to affected calves.

"It has not been definitely proved, but it is quite likely that a deficiency of iodin in the water, feed, and possibly the soil is responsible for the malady. Other unknown factors may also be considered as causal agents. Feeding experiments indicate that either water, feed, or both from a goitrous region may cause goiter.

"Perfectly controlled experiments with Angora goats show that goiter can be absolutely prevented by administering iodin to does during pregnancy. This can be given either in the form of potassium iodid per orem or tincture of iodin subcutaneously or on the unbroken skin. Field experiments also indicate that the condition can be successfully prevented in other species of animals by the use of iodin."

Accounts of this affection by Welch in Montana (E. S. R., 39, p. 187), and by Hart and Steenbock in Wisconsin (E. S. R., 40, p. 185) have been noted.

Observations on the body temperature of dry cows, M. KRISS (*Natl. Acad. Sci. Proc., 6 (1920), No. 9, pp. 539–541*).—The results of several series of observations have been summarized as follows:

"The rectal temperature was higher than the vaginal when measured at the same depth of 7 in., showing an average excess of about 0.3° F. The relative values, however, varied under different conditions but showed a trend toward parallelism. A fall in body temperature invariably followed the drinking of water. This fall varied directly with the quantity of water drunk. After the

effect of the water drunk in the morning has been overcome, the temperature remained fairly constant till about 2.30 p. m. When no water was drunk the temperature was practically constant in the morning and in the afternoon till about 2.30 p. m. There was a gradual rise in temperature in the afternoon from about 2.30 p. m. to about 5 p. m.

"Eating of feed raised the body temperature slightly for about a half hour when the cows received a maintenance ration. The temperature of the rectum or vagina was decidedly higher when measured at a depth of 6 or 7 in. than at a depth of 4 or 5 in. There was no material difference in temperature between a depth of 6 in. and one of 7 in., while there was a distinct difference of temperature between a depth of 4 in. and one of 6 in., thus showing the unreliability of measurements of temperature at a depth of less than 6 in.

"The standing as compared with the lying position of the animal had hardly any effect on the body temperature, but there was some indication that the temperature was slightly affected when measured shortly after the change in position had been made. There was no difference in body temperature when measured before or after defecation. Daily fluctuations in body temperature depend to a great extent on the individuality of the cow. A variation of 0.8° in the rectal temperature of the same animal was observed, when measured at the same hour of the day under identical conditions and outside the influence of water or feed, while under the influence of water a difference of 1.3° was observed at the same hour on two consecutive days."

Simplification and partial revision of the factors involved in the complement fixation test for infectious abortion in cattle, C. S. Gibbs and L. F. Rettger (*Jour. Immunol., 5 (1920), No. 5, pp. 399–416, fig. 1*).—This contribution from the Sheffield School Bacteriological Laboratory and the Connecticut Storrs Experiment Station consists of a simplification and standardization of the complement fixation test for infectious abortion in cattle, with particular emphasis on the preparation and titration of the antigen.

The only modifications of importance which have been made in the techinque of the test as previously described by Rettger and White (E. S. R., 39, p. 491) have been the adoption of the Wenner method of bleeding guinea pigs (E. S. R., 40, p. 479), the technique of which is described in considerable detail, the preservation of sheep corpuscles by the Bernstein and Kaliski method of formalinizing (E. S. R., 29, p. 676), and slight changes in the method of hemolysin production consisting in the intravenous injection of small but increasing doses (0.1 to 2 cc.) of washed undiluted sheep corpuscles into rabbits. From 0.5 to 1 cc. of the prepared corpuscles is injected into the marginal ear vein of each of two rabbits, followed one or two days later by 1 cc. of the same material, and on the third or fourth day after the first treatment by a final dose of 1.5 to 2 cc. The potency test is made four or five days after the last injection and, if satisfactory, the animals are killed not later than the tenth day after the third treatment. It is claimed that the hemolytic serum thus prepared is so active that a dilution of 1:100 is necessary to determine the titer with any degree of accuracy.

In the attempt to devise a uniform and reliable method of antigen production, a study was made of the influence of the age of bacterial cultures, different brands of peptone, different strains of *Bacillus abortus*, and the initial H-ion concentration of the medium on the antigenic properties of the bacterial growths.

The most satisfactory antigen growth was obtained on nutrient agar containing Fairchild peptone and having an initial H-ion concentration before sterilization of pH=6.5, resulting in pH=6.8 after sterilization for 15 minutes under 15 lbs. pressure. While it is thought to matter little what strain of *B. abortus*

is used for antigen production, the Bang strain was used almost exclusively in the study reported. It is suggested, however, that it may prove advantageous to use several strains and thus obtain a polyvalent antigen. The incubation period of the *B. abortus* cultures should not exceed four or five days, and concentrated stock antigen suspensions should be prepared immediately following the removal of the culture tubes from the incubator. From the concentrated stock suspension a dilution is made with carbolized saline solution to match tube 1.75 in the McFarland nephelometer. In conclusion the necessity is emphasized of using positive and negative sera as controls in all tests.

Bovine lymphangitis, A. L. Sheather (*Jour. Compar. Path. and Ther., 33 (1920), No. 3, pp. 158–185, figs. 10*).—"With pus taken from natural cases of bovine lymphangitis it has been found possible to reproduce the disease in plains calves to the extent that subcutaneous inoculation has led to the formation of an abscess and suppuration of the nearest lymphatic gland. The condition so produced resembled the natural disease in that the lesion developed very slowly and the suppurating glands showed little tendency to burst spontaneously, there was no rise of temperature, and the animals showed no general disturbance of health.

"The intraperitoneal inoculation of male guinea pigs with original pus has been followed in a very large proportion of cases by suppurative orchitis. With cultures of an organism isolated from pus derived from animals experimentally infected with original pus, it has been found possible to again produce similar lesions in both plains calves and guinea pigs.

"From the literature dealing with bovine lymphangitis it would appear that there are two distinct forms of the disease, one caused by a streptothrix (Nocard) and the other by a bacillus (Vryburg and Raymond). After considering the reports of Raymond and Holmes regarding their investigations into the same outbreak, the only conclusion that one can come to is that Raymond's is by far the more acceptable. The organism described in the present paper agrees in the majority of its characters with those described by Vryburg and Raymond. It differs in certain minor respects. Raymond's organism is described as being negative to Gram's method of staining but positive to Gram-Weigert, while the organism here described is negative to both. Vryburg does not mention the reaction to Gram-Weigert, but his bacillus was negative to Gram. Raymond's organism developed no surface growth on broth. Both Vryburg and Raymond obtained positive indol reactions. None could be obtained with the bacillus here described.

"Considering the differences, it may be pointed out that there is sometimes room for a divergence of opinion as to whether an organism is or is not positive to Gram and its modifications. The bacillus described in this paper was certainly negative to both, as an exposure of ten seconds to the respective decolorizing agents was sufficient to render it almost invisible. The development of a surface scum upon a proportion of the broth tubes was at first thought to be due to the presence of an impurity, but repeated plate cultivation indicated that it was not. A parallel case in which the development of a surface scum is not constant is to be found in the glanders bacillus. The bacillus does not appear to agree in all its characters with any of the pus-producing bacilli hitherto described. It approximates most closely to the Preisz-Norcard bacillus, but differs from that organism in being Gram-negative."

Regional anatomy of domestic animals.—III, Swine, E. Bourdelle (*Anatomie Régionale des Animaux Domestiques, III, Porc. Paris: J. B. Baillière & Sons, 1920, vol. 3, pp. 386, figs. 168*).—This third volume of the work previously noted (E. S. R., 41, p. 279) deals with the anatomy of swine. Many of the figures are illustrated in colors.

Infectious abortion in pigs, OPPERMANN (*Abs. in Vet. Rec., 32 (1920), No. 1662, p. 534*).—In one piggery observed by the author, 18 abortions were encountered among 28 sows between the second and third months of pregnancy. The author is of the opinion that the abortions were caused by diplo-streptococci which were encountered in the blood of the fetuses. The ten sows which remained upon the place were treated with antistreptococcic serum, in addition to disinfection of the premises, and no more cases of abortion occurred.

A contribution to the study of epizootic meningo-encephalitis of the horse, C. F. FLORES (*Rev. Soc. Med. Vet. [Buenos Aires], 4 (1919), No. 2, pp. 35–43; abs. in Vet. Rev., 3 (1919), No. 3, pp. 295, 296*).—Experiments with emulsions of brain from the softened areas, and defibrinated blood and cerebrospinal fluid of a horse killed at an advanced stage of the disease, caused the death of some inoculated animals in three or four days, while in others the disease ran a more chronic course and did not end fatally until the twentieth or even the forty-fifth day. Experiments with the emulsion after filtration through a Chamberland F candle indicated that the disease was not due to a filterable virus.

The control of fowl cholera by vaccination, E. GRIMM and W. PFEILER (*Berlin. Tierärztl. Wchnschr., 35 (1919), No. 17, pp. 139, 140*).—To illustrate the value of immunization against fowl cholera, the authors cite the following example:

In an epidemic of fowl cholera 32 hens (of which 2 were already ill), 2 geese, and 3 turkeys received a subcutaneous injection of serum and vaccine while 10 hens served as unvaccinated controls. Of those vaccinated, 1 of the 2 which had the disease at the time of vaccination died. All of the others remained well, while all of the controls died. The period of immunity is considered to be at least a year and a half.

Further contribution to the question of immunization against fowl cholera, W. PFEILER (*Monatsh. Prakt. Tierheilk., 31 (1920), No. 7–8, pp. 382–384*).—The value of immunization against fowl cholera as noted above is further shown by two cases, in one of which 83 fowls receiving serum and vaccine remained well while 5 of the 10 controls contracted the disease and died. In the other case 75 fowls which had been vaccinated remained well while 4 of the 6 controls died.

RURAL ENGINEERING.

Hydraulic tables, G. S. WILLIAMS and A. HAZEN (*New York: John Wiley & Sons, Inc., 1920, 3. ed., rev., pp. VI+115, pls. 2, figs. 6*).—This is the third revised edition of this handbook. It contains data on the elements of gaugings and friction of water flowing in pipes, aqueducts, sewers, etc., as determined by the Hazen and Williams formula, and on the flow and discharge of water over sharp-edged and irregular weirs, as determined by Bazin's formula and by experimental investigations upon large models.

Relationship of hydrogen-ion concentration of natural waters to carbon dioxid content, R. E. GREENFIELD and G. C. BAKER (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 989–991*).—Theoretical and experimental studies are reported in which the bicarbonate and free carbon dioxid contents of several samples of water were determined, together with the hydrogen-ion concentrations, the last being compared with the hydrogen-ion concentration calculated from the simple mass law equation of the primary ionization of carbonic acid. In only one case was the difference between the determined and calculated hydrogen-ion concentration greater than 0.3, and the mean variation was about 0.1. The wider variations occurred in the cases of low bicarbonate content, and somewhat larger variations occurred in cases of high free carbon dioxid than in similar cases with less carbon dioxid.

It is concluded that fairly accurate calculations of the hydrogen-ion concentrations of natural waters can be made in this way, and equations are developed for the purpose in which the carbon dioxid and bicarbonate are expressed in the manner in which they are ordinarily determined. These equations are less accurate with low bicarbonate concentrations and do not apply to waters alkaline to phenolphthalein.

Nitrate content of certain waters considered bacteriologically safe, M. S. Nichols (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 987–989*).—Studies at the University of Wisconsin of 808 bacteriologically pure waters are reported, from which the conclusions are drawn that an excessive quantity of nitrate nitrogen is not a normal component of safe ground waters, and that a water containing five or more parts per million of nitrate nitrogen should be considered as a potentially dangerous supply until a sanitary survey can be made by a competent person. It is further concluded that the nitrate-nitrogen determination should be included in every ground-water examination.

A handbook of testing materials, C. A. M. Smith (*London: Constable & Co., Ltd., 1920, 2. ed., pp. XIV+284, pls. 5, figs. 134*).—This is the second edition of this handbook, which describes methods, specimens, and apparatus used in the engineering testing of different materials. Data are also included on the actual properties of certain materials ascertained by tests. The scope of the book is indicated by the following chapter headings: Machines for tension, compression, and bending tests; strain-measuring instruments; methods and results of tests on materials; torsion testing; impact and hardness tests; shear and miscellaneous tests; alternating stress tests; the testing of cements, reinforced concrete, and stones; the testing of timber; and experiments in college laboratories.

A bibliography and tables of useful constants are included.

Proportioning concrete aggregates when unscreened or pit run gravel is used, L. A. Doan (*Engin. and Contract., 54 (1920), No. 22, p. 534, figs. 2*).—Graphic data, prepared by the Indiana Highway Commission, are given to permit the mechanical calculation of the amount of cement required or stone to be added where the percentage of fine aggregate is excessive in the use of pit-run gravel, in order to make the resultant mix approximate the standard requirements. The percentages of material passing and retained on a ¼-in. screen are first determined as a basis for the calculations.

The curves are based on the following formulas: $Y=\frac{AX}{C}$, in which Y is the required volume of cement in bags, X is the amount of fine aggregate in 1 cu. yd. of unscreened gravel, A is the required ratio of cement to fine aggregate, and C is a constant=0.035; $Y=C\ (B-AX)$, in which Y is the amount of screened gravel or stone to be added per bag-batch in cubic yards, and B is the bags of coarse aggregate required per bag-batch for a standard mix.

Compression tests of concrete from roads in Sacramento County, Calif., R. M. Morton (*Good Roads, n. ser., 20 (1920), No. 18, pp. 216, 218, 219*).—Compression tests of 148 samples of concrete taken from 17 different concrete roads, aggregating about 100 miles in length, in Sacramento County, Calif., are reported.

The concrete mixture was 1 part cement, 2½ parts sand, and 5 parts rock. Considerable variation was found in the compressive strength of the samples. The average breaking strength was 3,030 lbs. per square inch. Thirteen samples broke above 4,000 lbs., the highest being 4,609 lbs. This variation is not accounted for, but would seem to indicate that close regulation of equipment, labor, and materials is necessary to produce concrete of uniform strength. Concrete finished with an automatic tamper apparently possessed no greater

strength than that tamped by hand. Judging from the structure of the broken samples, the machine-tamped concrete seemed to contain more rock particles than the hand tamped.

The samples tested did not have sufficient height to make the ratio of height to diameter the standard 2:1, owing to the pavement thickness. For this reason the breaking strengths are believed to be from 16 to 40 per cent greater than would have been obtained with standard-sized samples.

Superelevation and widening of curves on Minnesota State highways, J. C. ROBBERS (*Engin. and Contract., 54 (1920), No. 22, pp. 541, 542, figs. 4*).—Tabular and diagrammatic data for this work are given.

Biennial report of the State Highway Commission of North Carolina, 1917–18, W. S. FALLIS (*N. C. Highway Comn. Bien. Rpt., 1917–18, pp. 86, pls. 20*).—Data on the work and expenditures of the North Carolina State Highway Commission for the years 1917 and 1918 are presented in this report.

Strength of shafts and beams, J. S. WATTS (*Amer. Mach., 53 (1920), No. 20, pp. 909, 910, figs. 3*).—A brief analysis of the stresses in shafts carrying given loads as beams is given, together with formulas and graphic data to determine the necessary sizes of such shafts.

How to repair broken gear teeth, G. H. RADEBAUGH (*Power Farming, 29 (1920), No. 11, pp. 16, 17, 22, figs. 18*).—Different styles of gears and gear teeth used on power farming machinery are described, and practical information is given on their repair, including numerous illustrations showing the different steps.

The carburetion of gasoline, O. C. BERRY and C. S. KEGERREIS (*Purdue Univ., Engin. Expt. Sta. Bul. 5 (1920), pp. 223, figs. 104*).—A large number of tests are reported to determine the influence of changing the richness of the fuel mixture, the speed of the engine, the load on the engine, the temperature of the incoming air, and the temperature of the mixture by the hot-spot method on the importance of an internal-combustion engine and its fuel requirements. Different engines and carbureters were used in order to broaden the scope of the results.

It was found that there is a very definite range of fuel mixtures which will give the most power in any engine when the temperature of the mixture is such as to make proper carburetion possible. This range extends a little above and a little below 0.0775 lb. of gasoline per pound of dry air. The richness of mixture for the highest power was not appreciably affected by the speed of or the load on the engine. It was affected by the dryness of the mixture, however, it being shown that with warm, dry mixtures an engine will pull well with mixtures that are leaner than can be used successfully when cold.

The effects of poor fuel distribution to the different cylinders by the intake manifold and of poor mixing of the fuel and air were found to be similar to those of using a cold mixture, causing a waste of fuel in order to deliver the highest power. The uniformity of the mixture of fuel and air in each cylinder was also found to be an important factor in the richness of the mixture delivering the highest power.

"The design of the carbureter and engine, especially the intake manifold, may and usually does affect some or all of these factors, and through them the richness of the mixture for highest power. By using a high grade of fuel, or a warm mixture, or both, these effects may be eliminated, and under these conditions the design of the carbureter or engine does not seem to have any effect."

"The range of mixtures through which approximately full power will be produced is quite wide, the richer mixture containing nearly twice as much fuel as the leaner ones. This range will vary somewhat with the brake load

carried, being widest at about half load, where with a dry mixture the engine will fire regularly at 0.055, pull nearly the highest load between 0.065 and 0.115, and continue to fire regularly up to 0.1275. At full load this range is diminished slightly, but at a very light load it is cut down for regular firing to between 0.07 and 0.095, and will miss badly at 0.065."

Advantages of magneto ignition, A. D. T. Libby (*Jour. Soc. Automotive Engin., 7 (1920), No. 3, pp. 277–287, figs. 17*).—In an analytical comparison of magneto with battery ignition for internal-combustion engines, the advantages of magneto over battery ignition are summarized as follows: Safer starting, more power, less fuel and oil utilization, cooler and smoother running engines, cleaner spark plugs, slower deterioration with age, greater compactness, and less dependence on the human element.

Operations in building tractors, F. H. Colvin (*Amer. Mach., 53 (1920), No. 20, pp. 877–883, figs. 26*).—Machine shop operations in tractor construction and assembly are described and illustrated.

Rolling resistance of tractor wheels, A. F. Moyer (*Soc. Automotive Engin. Trans., 13 (1918), pt. 1, pp. 405–419, figs. 12*).—Experiments, conducted at the engineering experiment station of the University of Minnesota on the rolling resistance of loaded wheels in freshly tilled, sandy, black loam soil, are reported. It was found that velocity is the all-important factor in developing formulas to indicate the rolling resistance for tractor wheels. Considerable graphic and mathematical data are given to illustrate this point.

Experience of eastern farmers with motor trucks, H. R. Tolley and L. M. Church (*U. S. Dept. Agr. Bul. 910 (1920), pp. 37, figs. 3*).—The results of a questionnaire indicating the experience of 753 farmers with motor trucks in the States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, and Maryland are reported.

The farms on which the trucks were used are of all sizes and types. The motor trucks varied in size from ½ to 5 tons, nearly half of them being 1-ton trucks, the preferred size. Only 18 per cent of the farms are less than 5 miles from the market, while nearly 25 per cent are 20 miles or more from the market.

The report indicates that the principal advantage of a motor truck is the saving of over half the time required by horses and wagons in hauling. The principal obstacles to its effective use are bad roads. A majority of the truck users still use horses for some road hauling and in most cases for hauling in fields and around buildings. About one-fourth of those reporting do custom hauling, receiving an average of $174 per year for this work.

Three-fourths of the trucks reported on operated on all or part dirt roads. Wind, snow, etc., were found to prevent the use of trucks on an average of about eight weeks per year. It is estimated that each truck travels an average distance of 3,820 miles per year and is used 173 days per year. Depreciation is the largest item of expense. Pneumatic tires are preferred for trucks of less than 1 ton and solid tires for those over 1 ton.

The average cost of operation of the ½-ton trucks was about 8 cts. per mile, of the ¾-ton about 13 cts., of the 1-ton about 12 cts., of the 1¼ and 1½ ton about 19 cts., and of the 2-ton trucks about 20 cts. The average cost of hauling crops, including the value of the driver's time at 50 cts. an hour, was about 50 cts. per ton-mile with the ½-ton trucks, 34 cts. with the ¾-ton, 26 cts. with the 1-ton, 24 cts. with the 1¼ and 1½ ton, and 18 cts. with the 2-ton trucks.

About half of the farms had decreased the number of work stock by at least one head since acquiring a truck. Less than 1 farm in 10 had disposed of more than two head. Over half of the farms of more than 120 crop-acres also had a tractor. This only slightly decreased the number of work stock.

Pneumatic-tire and motor-truck development experiences, M. D. Scott (*Jour. Soc. Automotive Engin., 7 (1920), No. 4, pp. 375-377, fig. 1*).—This is a summary of development of motor trucks with pneumatic tires since 1907. The development over a period of two and a half years is shown by a truck weighing 8,000 lbs. carrying a pay load of 7,000 lbs. as compared with a truck weighing 15,800 lbs. and carrying a pay load of 3,850 lbs., this being brought about largely by the use of pneumatic tires.

Other data are given which are considered to prove conclusively the practicability of using large pneumatic-tired trucks as a transportation method in comparison to railroad hauling over short distances.

Data on pneumatic tires and rims used on trucks, B. Darrow (*Jour. Soc. Automotive Engin., 7 (1920), No. 4, pp. 366-368, figs. 7*).—Practical data are given to familiarize truck engineers and others interested in truck design with facts and opinions which will assist in providing correct pneumatic tire and rim equipment for trucks. These include especially tabular data on sizes of pneumatic tires and weights of tire, wheel, and rim equipment.

What motor trucks need to supplement pneumatic-tire equipment, E. W. Templin (*Jour. Soc. Automotive Engin., 7 (1920), No. 4, pp. 369-374, 398, figs. 12*).—Data on motor truck design where pneumatic tires are used are given. It is shown that the main factors of the problem are speed, traction, shock effects, and emergency equipment.

Sunlight engineering in relation to housing and town planning, H. L. Seymour (*Jour. Roy. Astron. Soc. Canada, 14 (1920), No. 4, pp. 129-138*).—This is an abridgment of a paper presented to the Royal Astronomical Society of Canada, in which the author concludes among other things that isolated detached buildings should be constructed with their walls at an angle, preferably 45°, with the cardinal points of the compass, and that detached buildings as usually grouped in rural and residential districts should be similarly oriented.

Design for a reinforced concrete dairy barn loft floor, W. G. Kaiser (*Concrete [Detroit], 17 (1920), No. 5, pp. 161, 162, figs. 5*).—Construction details for a simple type of reinforced concrete loft floor for a dairy barn are given.

Reinforced concrete saw-tooth slab design, J. W. Pearl (*Concrete [Detroit], 17 (1920), No. 5, pp 163, 164, figs. 2*).—Formulas and graphic data are given for the design of reinforced concrete steps and stairs.

Farm electric light and power plant specifications (*Farm Mechanics, 4 (1920), No. 1, pp. 20-25, figs. 31*).—Specifications for 87 farm electric light and power systems of 72 different makes are tabulated, and photographs of several of the plants are included.

Poisonous gases from carbon tetrachlorid fire extinguishers, A. C. Fieldner, S. H. Katz, S. P. Kinney, and E. S. Longfellow (*Jour. Franklin Inst., 190 (1920), No. 4, pp. 543-565, figs. 5*).—An investigation of the decomposition products of carbon tetrachlorid fire extinguishers is reported.

Two methods of experimentation were used. The first consisted in applying the liquids to actual fires and to hot metal in a closed room of 1,000 cubic ft. capacity, where the gaseous products, mixed with air, could be retained and analyzed. The second method consisted in passing the vapors in air through heated tubes of iron or quartz where the humidity of the air and the temperature could be controlled.

It was found that phosgene, which is intensely poisonous, was found in toxic quantities in the gas chamber. Chlorin was formed in smaller amounts. Hydrogen chlorid gas was also formed. A considerable amount of carbon tetrachlorid vapor, which is a dangerous anæsthetic, also remained in the chamber. The experiments with the heated tubes confirmed the results obtained with actual fires.

As a result of these experiments it is recommended that carbon tetrachlorid fire extinguishers be not used on fires in closely confined spaces where conditions are such that the user can not escape without breathing the fumes.

Refrigeration, cold storage, and ice-making, A. J. Wallis-Tayler (*London: Crosby Lockwood & Son, 1920, 6. ed., rev., pp. XXIII+652, pls. 3, figs. 420*).—This is the sixth revised edition of a practical treatise on the art and science of refrigeration, which is written from the English viewpoint. It also includes considerable information on refrigerating and ice-making machinery.

RURAL ECONOMICS AND SOCIOLOGY.

Can the farms of the United States pay for themselves? G. Stewart (*Jour. Farm Econ., 2 (1920), No. 4, pp. 177-193*).—This paper is a contribution from the Utah Experiment Station. Data from published surveys of 26 typical areas in 21 States of the United States are brought together, indicating the difficulty under present conditions of paying for a farm from the proceeds of it.

A summary is given of the capital, farm income, and labor income, and interest on the capital is computed at 5, 6, 8, or 10 per cent. The annual payment necessary to amortize the farm in 10, 20, or 30 years with interest on the mortgage at 5, 6, 8, or 10 per cent is computed by a formula on the basis of the average capital invested in farms of the various areas surveyed. Taken together with figures arrived at for the difference between farm income and the necessary payments, these indicate that no average farms pay for themselves in 10 years or even in 20 years at 5 per cent or higher interest. Farms of a few regions can do so in 30 years with small cash balances left for family expenses.

It is concluded that these farms seem overcapitalized, and the increasing tendency toward tenancy is thus partially explained. More than average business ability and training and experience are deemed essential to earning a living and at the same time saving enough to buy the farm.

Surveys of three typical farm areas in Arkansas, A. D. McNair (*Ark. Agr. Col. Ext. Circ. 93 (1920), pp. 32, figs. 7*).—Surveys here noted embraced 70 farms in Pulaski County in the central part of the State, 50 farms in Columbia County in the southwestern part, and 50 farms in Lee and Phillips Counties in the eastern part, crop areas of which averaged 40, 54, and 78 acres per farm, respectively. The percentages of the crop area devoted to cotton were 41 on the first group and 54 on each of the other groups, those of corn being 37, 33, and 32 per cent, respectively.

Farmers having 50 per cent or a little more of the crop in cotton generally made better farm-labor incomes than those having less. The 10 most successful farms in each group exceeded the average for the group in size of farms, acres of crops per farm, yield of crops, acres of crops per man and mule, and value of crops per man and mule. The labor incomes of colored farmers compared favorably with those of white farmers, difference of size of holdings being taken into consideration. Likewise renters made larger labor incomes than owners. The surveys covered crop labor and time required per acre, as well as the value of the family living, which is said to have been greater on the larger farms, greater for owners than renters, and greater for white people than for colored.

The A. A. W. practical farm accounting system (*Coshocton, Ohio: Amer. Art Works, 1918, pp. [1]+48*).—Blank forms are provided for recording details of the farm and household investment, as well as the cost of production and sale of crops and live stock.

Annual report of proceedings under the Tithe, Copyhold, Inclosure, Commons, and other Acts for the year 1919 (*[Gt. Brit.] Min. Agr. and Fisheries, Proc. Tithe, Copyhold, Inclosure [etc.] Acts, Ann. Rpt. 1919, pp. 26*).—Report is made of the activities of the Tithe, Copyhold, and Commons Branch

of the British Ministry of Agriculture and Forestry during the year 1919, especially in the matter of carrying out the provisions of the Tithe Act of 1918 in regard to redemption of tithe rent charges. Information regarding transactions under these acts for a period of years is summarized in tables in the appendixes.

The agrarian question in Roumania, G. Mantou (*Jour. Économistes [Paris], 79 (1920), pp. 330–340*).—This gives a brief review of conditions leading up to legislation for the expropriation of cultivable public lands, rural holdings under the control of absentees, and those belonging to aliens, to be given over in small holdings for peasant cultivation. It is said that further assistance in the matters of agriculture credit and education are necessary for the social and economic independence of small proprietors so established.

Supply of labor relative to the demands, hours of work and wages in agriculture in Sweden, 1918 (*Sveriges Off. Statis., [Sweden] K. Soc. Styr., Arbetartillgång Arbetstid, 1918, pp. 61; abs. in Internatl. Inst. Agr. [Rome], Internatl. Agr. Econ., 11 (1920), No. 9, pp. 646–649*).—Data from answers to an official detailed inquiry returned by presidents of communal assemblies in 2,182 communes in Sweden are tabulated. The results show that in 4.7 per cent of the communes the supply of labor was good, in 58.9 it was sufficient, in 34.4 insufficient, and that 2 per cent of the communes were not able to give definite answers. As compared with those for previous years these figures show an improvement as regards agricultural labor. Work hours of agricultural laborers, carters, and workers in charge of live stock, as well as wages paid to unmarried farm servants, laborers paid partly in kind, permanent and transient day laborers, and women employed in agriculture, are reported.

During the years 1913–1918 the total earnings of farm servants have increased by between 130 and 140 per cent. The general rise in the level of wages during these years was about 120 to 150 per cent.

Report to the Board of Agriculture for Scotland on agricultural credit and organization in France, with suggestions for a Scottish scheme of agricultural credit, H. M. Conacher and W. R. Scott (*Edinburgh: Scot. Bd. Agr., 1920, pp. 69*).—This report is a continuation of one on the economics of small farms and small holdings in Scotland previously noted (E. S. R., 43, p. 594), making first a comparison of agricultural production in the United Kingdom and France. The formation of agricultural syndicates in France for practical aid to cultivators of the land and for economic and social service to the rural population, their relation to the local and regional banks, and collective societies of production are noted. The Government machinery providing long-term credit to individuals for the purpose of the acquisition, improvement, transformation, reconstitution of small agricultural holdings in France, societies of agricultural credit in Italy, and systems of cooperative dairying in France and Scotland are described. The report arrives at a scheme of organization of credit for Scotland providing for the issue of short-term loans to cooperative trading societies and to individual farmers and crofters for the purchase of stock, also for the issue of long-term loans to societies of cooperative production, to individuals, and to stock insurance societies, and methods of financing such loans are recommended. A brief description is given of the system of Metayage in France.

In appendixes are copies of various French laws relating to agricultural credit societies, reports of operations of regional banks, and an outline of the conduct of cooperative cheese schools.

Agricultural credit during the war, H. Sagnier (*Jour. Agr. Prat., n. ser., 34 (1920), No. 31, pp. 97, 98*).—This brief note covers the operations of co-

operative credit societies and local and regional banks in France, mainly since 1914.

Agricultural syndicalism, E. Martin Saint-Léon (In *Syndicalisme Ouvrier et Syndicalisme Agricole. Paris: Payot & Cie., 1920, pp. 73-160*).—Outstanding features of the French law of 1884 and legislation of subsequent dates, authorizing the formation of syndicates among farmers and farm laborers in France and the establishment of local and regional banks, cooperative credit societies, and agencies for insurance are outlined. The economic benefit to agriculture accruing from professional organization among its forces is emphasized, together with certain important educational and social advantages.

Organizations among Ohio farmers, H. E. Erdman (*Ohio Sta. Bul. 342 (1920), pp. 115-166, figs. 14*).—This information on the number, kinds, and activities of farmers' cooperatives in Ohio was gathered from visits and by letters and questionnaires to various organizations and to farmers. They have been grouped as organizations whose main business is buying and selling, production, and farm improvement, and mutual service organizations. Some statistical material is tabulated, and the location in the State of a number of different kinds of organizations is illustrated.

In conclusion it is conservatively estimated that the total membership in June, 1919, amounted to 350,000, or about twice the number of farms in the State, owing to inclusion of several members of a family or one individual's holding membership in more than one company, and that for the three groups in which there is little duplication in membership, namely, farmers' elevators, and supply and fruit companies, more than 23,000. The farm bureau membership included approximately two out of every seven farmers, and mutual insurance companies an even larger proportion.

The farmers' elevator movement shows a tendency toward larger companies owning and operating elevators in several neighboring towns. Farm improvement associations are said to be relatively new. Labor conditions have favored thrashing rings and silo-filling clubs.

Cooperative marketing by West Virginia farm bureaus, A. J. Dadisman (*West Virginia Sta. Circ. 33 (1920). pp. [4], fig. 1*).—Data for this circular were secured from 32 West Virginia county farm bureaus relating to their cooperative purchases and sales. These were collected and checked by C. C. Anderson during the spring of 1920. Amounts and methods of cooperative purchases, methods of ordering and handling, cost of commodities, and amounts of sales and gains by selling cooperatively are tabulated.

Cooperative cane-sirup canning: Producing sirup of uniform quality, J. K. Dale (*U. S. Dept. Agr., Dept. Circ. 149 (1920), pp. 19*).—Suggestions are made regarding the arrangement and operation of a plant to be owned cooperatively by producers in cane-growing areas in the South, describing the grading of the sirup as received, mixing, reheating and bringing to the proper density, canning, labeling, and crating the cans ready for shipment.

Estimates of the costs of canning and marketing are given. It is roughly calculated that the total cost of canning 100 gal. might be about $18.

It is said that such a project would be expected to secure a uniform product, assured markets, increased sales, and profitable pooling of returns, as well as to save time for the farmers.

Report of a committee appointed to inquire into and report upon the desirability or otherwise of establishing grain elevators in South Africa, together with covering report of general manager of railways and harbors, 1918 (*Pretoria: Union So. Africa, Grain Elevator Com. Rpt. 1918, pp. [2]+108*).—Emphasizing the growing demand on the part of all interested in the grain production of South Africa for an elevator system under State super-

vision, claiming a direct financial saving of about £500,000, and urging material advantages in matters of handling, storing, and transportation of grain, providing an impetus to increased production, saving of labor, and indisputable weighing and grading, this committee recommends that port and country elevators of stated capacity be erected immediately at points listed in the report, and that the system be under the ownership of the Government and operated by the Administration of Railways and Harbors.

It is estimated that the total annual costs for interest, depreciation, repairs, and cost of operation of elevators should not exceed 6d. per 200 lbs., and that charges for receiving grain into and disposing from elevators, grading, cleaning, 15 days' storage in each elevator, insurance against all risks, and issue of negotiable warehouse receipts should amount to that same sum. In other words, the system should be self-supporting financially, but no profits should be made out of the tariffs levied.

As annexures to the report proper are included statistics of shipments of corn and wheat throughout the Union of South Africa in 1917 and 1918, extracts of other information reviewed under the terms of the inquiry in regard to conditions of handling grain in Canada, the United States, and Australia, and statistics of the international production and trade in corn and wheat.

A bibliography of 56 references is given.

Harmonizing the interests of farm producer and town consumer, E. G. Nourse (*Jour. Polit. Econ., 28 (1920), No. 8, pp. 625–657*).—The author discusses the farmer's discontent over seeming to receive a lesser share of social advantages and representation in governmental affairs as a reward for his labor than does the consumer. He points out that the danger of alliance with labor principles is past, however, because of the bourgeois, property owning faction in the farming class, owning as well as borrowing capital, and constitutionally opposed to strikes and labor philosophy in general.

It is said that the producer-consumer controversy will be solved only by ultimate harmony in the production of raw materials on the land and productive consumption in the city, with a raito of exchange between products of rural and urban labor proportionate to the exertion and skill involved. A pooling of the interests of producers and consumers and a reaction toward economic reconciliation is said to be seen emanating at the same time from the consumers toward the farm and from the producers cityward.

[Comparison of defects found in drafted men from rural and urban districts], compiled by A. G. Love and C. B. Davenport (*Washington: War Dept. [U. S.], Surg. Gen. Off., 1920, pp. 276–283, 348–417, 1102–1213, 1228–1323, 1464–1643*).—Statistical information, compiled from draft records of more than two million men of military age, is given in these pages. From the figures given, it appears that defects were found only seven-eighths as commonly in rural as in urban districts. Comparative tables and graphic representations are given. One table shows for the various defects the rural ratio divided by the urban for the whole United States, arranged in order of size of this ratio. Detailed tables noted in the appendix show distribution of defects and rejections for the earlier and later periods of the draft by States, physiographic, industrial, and population sections, and rural and urban districts.

The farm woman's problems, F. E. Ward (*U. S. Dept. Agr., Dept. Circ. 148 (1920), pp. 24, figs. 8*).—Report is made of a survey of about 10,000 homes in 241 counties of 33 Northern and Western States made in June and October, 1919, by the U. S. Department of Agriculture in cooperation with the State colleges of agriculture and county farm bureaus.

Some of the incomplete returns have been previously noted from other sources (E. S. R., 43, p. 894; 44, p. 192.)

It is revealed that the average working day, summer and winter, for over 9,000 farm women was 11.3 hours, and 87 per cent of 8,773 women report no regular vacation. The following table summarizes some of the other information gained:

Equipment of farm homes surveyed.

Section of country.	Running water.	Power machinery.	Water in kitchen	Washing machines.	Carpet sweeper.	Sewing machines.	Screened windows and doors.	Outdoor toilet.	Bath tub.	Sink and drain.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Eastern	39	8	85	52	58	94	95	79	18	80
Central	24	22	60	64	46	95	98	89	19	52
Western	36	12	45	48	29	95	91	86	25	44
Average	32	15	65	57	47	95	96	85	20	60
Number of records	9,374	9,080	9,374	9,580	9,513	9,560	9,667	9,580	9,679	9,334

The answers given to questions regarding hired help employed; outdoor work; distance to school, church, physician, hospitals, etc.; number of children in the home; and number of sick or incapacitated to be cared for are also tabulated or summarized.

The five outstanding problems indicated in this study are the necessity of shortening the working day of the average farm woman, lessening the amount of heavy manual labor she performs, bringing about higher standards of comfort and beauty for the home, safeguarding the health of the family, and developing and introducing money-yielding home industries where necessary to get funds for needed home improvements. The organization of the extension service for helping in the solution of some of these problems is presented.

The farm woman's problems, F. E. WARD (*Jour. Home Econ., 12* (*1920*), *No. 10, pp. 437–457*).—Certain tables containing data from the survey noted above are given with discussion.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 2* (*1920*), *Nos. 24, pp. 369–384, figs. 2; 25, pp. 385–400, figs. 2; 26, pp. 401–416*).—Abstracts of information on the domestic movement, imports and exports, prices, and relative market conditions of specified commodities, and prices of agricultural products, as well as foreign market information, are given in these numbers.

Report is made in No. 24 of a special investigation by the Bureau of Markets regarding the German cotton milling industry. Considerably reduced capacity, owing to the loss of Alsace Lorraine and the shortening of the working day, is indicated. It is said that further, because of lack of export orders and fuel, Germany could consume the maximum of only 700,000 bales of American cotton, as compared with 1,800,000 used under prewar conditions.

No. 25 gives figures compiled by the Bureau of Markets, showing the trade between the United States and Canada in wheat and flour for consumption. It is shown that imports of Canadian wheat during the first 10 months of 1920 exceed those for the corresponding period of 1919 by 9,617,560 bu. Our exports of wheat and flour to Canada during the same period exceed those of 1919 by more than 12,000,000 bu.

General declines in live stock, grain, fruit, and vegetables, hay, and dairy product markets are shown.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul., 7* (*1920*), *No. 34, pp. 15, fig. 1*).—This number contains the usual partial list of products which farmers have for sale.

Live-stock census in Sao Paulo (*Sec. Agr. Com. e Obras Pub. Estado São Paulo, Serv. Pub., 1919, pp.* [*5*]).—Census returns are given, enumerating live stock by classes and agricultural holdings grouped according to size.

Variations in the numbers of live stock and in the production of meat in the United Kingdom during the war, J. B. GUILD (*Jour. Roy. Statis. Soc., n. ser., 83 (1920), No. 4, pp. 533–571*).—This paper comprises a detailed statistical study based on census figures and estimates on returns collected since the outbreak of the war by the Ministries of Food and Agriculture for Great Britain. The main points brought out are the seasonal variations in the number of live stock existing in the country and the rate of slaughter and the average carcass weight of meat animals. A brief comparison is made of the significant changes in the United Kingdom with those of continental countries.

Discussions were given to the paper by H. Rew, Macrosty, and Goodsir.

[Statistics of agriculture in Denmark, 1908–1916] (*Danmarks Statis. Meddel., 4. ser., 58 (1919), No. 1, pp. 1–61*).—Revised tables with interpretative text in these pages show the area cultivated, total production, 1908–1914, in hundredweight and, 1908–1916, in tons by departments, and yields per acre in hundredweight.

[Agricultural statistics of Sweden] (*Statis. Årsbok Sverige, 1919, pp. 70–91; 1920, pp. 70–91*).—These sections of these annual reports continue information previously noted (E. S. R., 40, p. 294).

[Land tenure and settlement: Agriculture and live stock in the Union of South Africa] (*Union So. Africa, Off. Yearbook, No. 3, (1919), pp. 452–480, 486–539, 892–897, 924, 925, 936, 937, 954–956*).—Matters previously noted (E. S. R., 42, p. 90) are dealt with, mainly as of the period 1910–1918. Similar information with respect to Basutoland, Bechuanaland Protectorate, and Swaziland has been included for the first time in this issue.

AGRICULTURAL EDUCATION.

The organization and functions of the departmental and regional agricultural offices (*Notice sur l'Organisation et le Fonctionnement des Offices Agricoles Departementaux et Régionaux. Paris: Min. Agr., 1919, pp. 48*).—This pamphlet contains the texts of the French Government decrees of January 6 and April 25, 1919, as well as other decrees and circulars relating to the creation, organization, functions, and distribution of departmental and regional agricultural offices in France, and to increased agricultural production.

The position of agricultural institutes, J. C. NEWSHAM (*Jour. Univ. Col. Wales, Agr. Dept., 9 (1920), pp. 37–39*).—Largely because of his own observations as principal of an agricultural institute for 20 years, the author is of the impression that owing to the altered condition of agriculture brought about in the last few years, the agricultural or farm institutes throughout England and Wales will now more probably prove of considerable importance as demonstration farms rather than attract the type of pupil for whom they were originally intended, viz, the sons of small tenant farmers, embryo small holders, and youths whose parents are not in a position to finance their sons' agricultural training elsewhere. It is suggested, in view of the excessively high cost of building and equipping a modern agricultural institution, that adjoining counties cooperate in providing a number of scholarships to one institute or in maintaining a single institute capable of accommodating some 50 resident students to serve the needs of a comparatively large district, rather than to have one small institution in each county.

The training of agricultural teachers, JOHN (*Fühling's Landw. Ztg., 69 (1920), No. 11–12, pp. 220–226*).—In this discussion of the training of agricultural teachers the author calls attention to the plans followed in this respect in Prussia and Saxony, the only German States that have made provision for pedagogical instruction.

In Prussia agricultural teachers in training who have taken the teacher's examination without pedagogical preparation are sent to one of the seminars in connection with the agricultural schools at Weilburg, Hildesheim, and Eldena, where they receive theoretical and practical training in methods of teaching during 12 hours a week for a year. It is held that scientific training must be completed before pedagogical training can be begun because of the short duration of the high-school (college) course. The author believes that if a fourth year is added to the course it should include the practical training in methods of teaching. He is also in favor of giving instruction in pedagogics in the training of agricultural teachers in the university or high school as is done in the Agricultural Institute of the University of Leipzig, Saxony, which has a pedagogical seminar for agricultural teachers provided with a special practice school offering a three-year course in agriculture and horticulture to farm boys from 14 to 18 years of age (who have been exempted from the obligatory continuation school) during two half days a week throughout the year. On the completion of the pedagogical training in Prussia a thesis is required, while at Leipzig a written and verbal examination must also be taken.

Rural continuation instruction, K. JUKEL, E. ERLER, A. POSTELT, and H. KALLBRUNNER (*Wiener Landw. Ztg., 70 (1920), Nos. 5, pp. 29, 30; 12, pp. 88, 89; 16, p. 119; 20, p. 150*).—Discussions are given of the feasibility of agricultural instruction in proposed rural continuation schools in Austria.

Plans and directions for vocational agriculture in West Virginia, C. H. WINKLER (*W. Va. Dept. Schools, Div. Vocat. Agr., Bul. 2 (1920), pp. 40*).—This is an outline of the plans for the administration and supervision of instruction in vocational agriculture and teacher training under the Smith-Hughes Act in West Virginia in 1920–21.

Two types of teacher-training work, viz, for the improvement of teachers already in service and for the training of teachers enrolled as students, are provided for by the department of agricultural education of the College of Agriculture, West Virginia University. The regular four-year course, which is outlined, requires 144 semester hours for graduation, 104 hours being prescribed, and the remaining 40 hours elective from such courses as may be prescribed by the class officer. The vocational agricultural department in the local high school is used for observation and practice teaching. The completion of this course will satisfy the State requirement for a special certificate in vocational agriculture. The special professional work offered in the university summer school and in the extension classes will enable graduates of the college of agriculture to complete the required special work to secure this special certificate without examination. Topical outlines are given of one-year courses, arranged in seasonal sequence, in crop production and animal husbandry, including field and laboratory studies, minimum equipment, and suggestive farm shop practicums and equipment.

A statement of policy as to the relation of Smith-Hughes and Smith-Lever work in the State is included.

Agricultural project record book for Smith-Hughes schools, C. W. WATSON (*Chicago: Univ. Pub. Co., 1920, pp. 50*).—This is a book of project record forms prepared for the use of Smith-Hughes students of vocational agriculture in Nebraska.

Shall my son become a horticulturist? (*Soll Mein Sohn Gärtner Werden? Dresden: Ausschuss Gartenbau Landeskult. Rat Sachsen, 1919, pp. 24*).—This pamphlet, issued by the committee for horticulture of the Agricultural Council for Saxony, discusses the theoretical and practical training necessary, as well as the physical, mental, and moral requirements for the profession of horticulture, and opportunities open to horticulturists.

Geology as a subject of study in agricultural high schools and academies, E. Blanck (*Fühling's Landw. Ztg., 66 (1917), No. 21–22, pp. 427–438*).—This is a discussion of the fundamental principles of a course in geology for agricultural high schools and academies (collegiate). The author holds that geology should never be taught in these institutions as an independent subject, but only in its relation to agriculture as determined by the needs and aims of soil study which, however, should treat of the soil not only from the standpoint of its uses for agricultural industries but also from higher scientific viewpoints, such as geological phenomena.

A little gateway to science, E. M. Patch (*Boston: Atlantic Mo. Press, 1920, pp. XVII+179, figs. 43*).—The life histories of 12 hexapods are told in story form for children.

Lessons in animal production for southern schools, E. H. Shinn (*Fed. Bd. Vocat. Ed. Bul. 56 (1920), pp. 134*).—This bulletin, as stated, is intended to offer suggestions in methods and materials to teachers of vocational agriculture for teaching the fundamental principles and practices in animal production. One hundred lessons in poultry, swine, and beef-cattle production and dairying are outlined. They are adapted to the seasonal, agricultural, and school conditions of the Southern States, and suggest sources of information, illustrative material, study questions, class and practical exercises, projects, and shop practice. Topical outlines on horses and sheep are also included.

Live stock judging for Virginia club members, R. E. Hunt (*Va. Agr. and Mech. Col. and Polytech. Inst. Ext. Bul. 61 (1920), pp. 48, figs. 21*).—The author calls attention to the importance of live stock judging, explains the purpose of the score card, and outlines and discusses score cards for draft horses, beef cattle, a dairy cow, fat sheep, and fat hogs of the lard type.

Bird study in elementary schools, R. G. Leavitt (*Natl. Assoc. Audubon Socs., Bul. 4 (1920), pp. 103–146, figs 12*).—This bulletin contains a brief discussion of reasons for bird study in the elementary schools, accounts of typical instances of successful bird study, and a plan of action for the teacher, including junior Audubon classes and clubs, the school museum, attracting birds to the school or home, books and reading, pictures, etc.

How to build bird houses and kites, H. W. Carmichael (*Des Moines, Iowa: Successful Farming, [1919], pp. 29, figs. 13*).—Directions are given.

Farm mechanics in Utah high schools: A record of achievements, 1919–20 (*Salt Lake City: Utah State Bd. Vocat. Ed., Div. Agr. Ed., [1920], pp. 44, figs. 26*).—This bulletin contains reports on the work of the farm mechanics departments of 10 high schools in Utah. Detailed outlines are included of two 2-year courses in farm mechanics extending through 24 weeks and 36 weeks a year, respectively.

Operation of the Smith-Lever Act and its bearing on future educational legislation, A. F. Woods (*Ed. Rec., 1 (1920), No. 4, pp. 175–178*).—In this address, delivered at the third annual meeting of the American Council on Education on May 7, 1920, the close relation between boys' and girls' club work and the school system is pointed out. The author is of the opinion that Smith-Lever extension work is not simply administrative work, but educational work, and hence must be considered in its relation to such new Federal legislation for education as the proposed new Department of Education.

Attention is also called to a suggestion that possibly the research and educational work of the U. S. Department of Agriculture and similar work in other national departments might be brought together and organized into something like the university of the United States. All such work would be centered under a secretary who would function in relation to it the same as the secretaries of the various departments now do. This would separate the administrative and

police functions from the educational and research functions. The author concludes that "those who have given the matter much study realize that separation of education and research would be destructive to both. Those of us interested in coordinating the various phases of Government work desire to see the closer relationship maintained."

Statistics of cooperative extension work, 1920–21 (*U. S. Dept. Agr., Dept. Circ. 140 (1920), pp. 18*).—This is a summary of statistics relating to sources, amounts, and project allotment of funds used, and number and distribution of persons employed by the State agricultural colleges receiving the benefits of the act of Congress of May 8, 1914 (Smith-Lever Act), providing for extension work in agriculture and home economics in cooperation with the U. S. Department of Agriculture. The text of the act is appended.

Traveling publicity campaigns, M. S. ROUTZAHN (*New York: Russell Sage Foundation, pp. XI+151, pls. 19*).—This contribution from the survey and exhibit department of the Russell Sage Foundation describes how specially equipped railroad trains, trolley cars, and motor vehicles have been used in educational tours in agricultural and home economics extension work, child welfare, and public health campaigns and similar enterprises, and includes a bibliography of the subject with lists of illustrations available.

MISCELLANEOUS.

Annual report of the director for the fiscal year ending June 30, 1919 (*Delaware Sta. Bul. 125 (1919), pp. 30*).—This contains the organization list and a report of the director on the work and publications of the station, including a financial statement for the fiscal year ended June 30, 1919. The experimental work recorded is for the most part abstracted elsewhere in this issue, or noted previously (E. S. R., 44, p. 366).

Annual Report of Iowa Station, 1919 (*Iowa Sta. Rpt. 1919, pp. 55*).—This contains the organization list and a report by the director on the work of the station, including a financial statement for the fiscal year ended June 30, 1919. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of Massachusetts Station, 1919 (*Massachusetts Sta. Rpt. 1919, pts. 1–2, pp. 47a+268, pls. 14, figs. 34*).—This contains the organization list, reports of the acting director and heads of departments, a financial statement for the fiscal year ended June 30, 1919, and reprints of Bulletins 189–194, previously noted. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Report of Porto Rico Station, 1919 (*Porto Rico Sta. Rpt. 1919, pp. 37, pls. 4*).—This contains the organization list, a summary by the agronomist in charge as to the general conditions and lines of work conducted at the station during the year, and reports of the chemist and assistant chemist, horticulturist, entomologist, assistant in plant breeding, specialist in farm management, and agricultural technologist. The experimental work reported is for the most part abstracted elsewhere in this issue.

The work of the Newlands Reclamation Project Experiment Farm in 1919, F. B. HEADLEY (*U. S. Dept. Agr., Dept. Circ. 136 (1920), pp. 21, figs. 4*).—The agricultural conditions on the project are described, and the experimental work of the year reported, as abstracted elsewhere in this issue.

The handbook for practical farmers, edited by H. FINDLAY (*New York and London: D. Appleton & Co., 1920, pp. XVII+558, pl. 1, figs. 258*).—This handbook consists of 37 chapters on various phases of agriculture, contributed for the most part by specialists from the agricultural colleges and experiment stations and the U. S. Department of Agriculture.

NOTES.

California University and Station.—John W. Gilmore, professor of agronomy and agronomist, has been appointed exchange professor from the United States to the University of Chile for the academic year 1921–22.

Delaware College and Station.—The appropriations for the station and college farm were increased by the legislature from $10,000 to $20,000 per annum. A bill to provide for a combined dairy and stock judging building on the college farm failed of passage.

Kansas College.—The 8-week farmers' short course and the commercial creamery short course were concluded on March 5. The total attendance at the two courses was 106, representing 52 counties in Kansas, 6 outside States, and 1 foreign country.

A poultry short course for veterinarians was held during the week ended February 26, when special attention was given to poultry diseases and poultry culling. Sixty-four veterinarians enrolled from 31 counties.

On February 17 and 18 an ice-cream scoring contest was held at the college for the benefit of the ice-cream manufacturers of the State. There were 42 samples entered in the contest, submitted by 28 of the leading ice-cream manufacturers.

Walter W. Burr, director of rural service in the extension division, has been appointed professor of sociology in the department of economics. David L. Mackintosh has been appointed instructor in animal husbandry.

Maine Station.—Dr. W. J. Morse, plant pathologist, has been appointed director of the station.

Massachusetts College.—Dr. C. H. Fernald, associated with the college for nearly 35 years and widely known among entomologists, died February 22 at the age of 83 years.

Dr. Fernald was a native of Maine and received his education at the Maine Wesleyan Seminary, subsequently receiving the degrees of M. A. from Bowdoin College and Ph. D. from the Maine State College. During the Civil War he served in the U. S. Navy as acting ensign, and for six years following was principal of Litchfield and Houlton academies in Maine. In 1871, he was appointed professor of natural history in the Maine State College, leaving that institution for the Massachusetts College fifteen years later to become professor of zoology and lecturer in veterinary science. In his work, however, he gave special prominence to economic entomology, developing courses and carrying on investigations of world-wide reputation. He also served as acting president in 1892–93, and in 1908 became the first director of the graduate school. Failing health necessitated his retirement in 1910, with the title of honorary director of the school.

Some of Dr. Fernald's most important work was done in the training of an unusual number of well-known economic entomologists. He was also an early worker on the gipsy and browntail moths in this country and prominently associated with the early campaigns of the State of Massachusetts against these insects. His publications dealt especially with the Crambidæ, Pterophoidæ, and Pyralidæ of North America, and the Sphingidæ and Orthoptera of New

England, but also covered numerous other lines. He was a member of several entomological and other scientific organizations, and president of the American Association of Economic Entomologists in 1896.

William C. Sanctuary, head of the department of poultry husbandry and vice director of the State agricultural school at Morrisville, N. Y., has been appointed professor of poultry husbandry, beginning September 1, next.

Mississippi Station.—D. J. Griswold, animal husbandman, has resigned to accept a similar position at the North Dakota Station. R. M. Rea has resigned as foreman of the Delta Substation and has been succeeded by I. P. Trotter, formerly fellow in agronomy at the Central Station. L. C. Graves has been appointed fellow in agronomy.

Missouri University.—The legislature has appropriated $200,000 for a new agricultural building and $25,000 for a new beef cattle barn, as well as smaller amounts for improvements, repairs, and additions to equipment. The total appropriation for the college of agriculture is 110 per cent larger than two years ago.

The new home economics building is nearing completion.

Ray E. Miller, assistant professor of agricultural education, has resigned to become county agent in Cass County.

Montana College and Station.—The fiscal year has been changed by the legislature to begin July 1. For the ensuing year the appropriations granted aggregate $451,140, and for the year following $491,000. The respective grants to the college are $200,000 and $220,000; for the station, $93,700 and $100,000; for the State grain laboratory, $11,240 and $12,000; and like amounts for the Judith Basin Substation. The horticultural substation will receive $5,620 and $6,000, the Huntley Substation $2,000 and $3,000, and the North Montana Substation $19,540 and $20,000. Appropriations totaling $190,518 are also made for extension work, $19,282 for farmers' institutes, and $16,000 for rodent control.

A bond issue approved by popular vote some time ago has been declared constitutional by the State supreme court. It is expected that this decision will render available to the college over $1,000,000 for buildings.

New York State Station.—Dr. U. P. Hedrick has been appointed vice-director, beginning July 1. Theodore E. Gaty, assistant in horticulture, resigned April 1 to take up farming.

Pennsylvania College and Station.—Dr. Margaret B. MacDonald, professor of food and nutrition for over ten years, has resigned. C. O. Cromer, of the Indiana College and Station, has been appointed associate professor of agronomy.

Virginia Station.—M. O. Wilson, superintendent of the county station at Charlotte Court House, was granted leave of absence March 1, to assist in organizing tobacco growers. H. C. Marshall will have charge of the station work in his absence. James F. Eheart, assistant plant pathologist, resigned March 1.

Virginia Truck Station.—Loren B. Smith has resigned as associate State entomologist to accept a position with the Bureau of Entomology, U. S. Department of Agriculture, and will be located at Riverton, N. J., in connection with the Japanese beetle investigations.

Wyoming Station.—A. T. Cundy has been appointed assistant chemist.

Experiment Station Record.—Joseph W. Wellington, horticulturist in the potato investigations of the Bureau of Plant Industry, U. S. Department of Agriculture, has been appointed specialist in horticulture and forestry on this journal, beginning April 1, vice E. J. Glasson, whose death has been already noted.

Association of Southern Agricultural Workers.—The twenty-second annual convention of this association was held at Lexington, Ky., February 15 to 17, with delegates from nearly all of the agricultural colleges in the South and a number of visitors in attendance.

Addresses of welcome were given by W. C. Hanna, Commissioner of Agriculture of Kentucky, and President F. L. McVey, of the University of Kentucky. The latter emphasized the part that the colleges must play in training men for research and the necessity of educating the public to an appreciation of scientific investigation. The president of the association, D. T. Gray, of the North Carolina Station, briefly reviewed the past, present, and future work of the association.

The balance of the morning session was devoted to papers and discussion on the need of increased funds for the experiment stations and the means of securing them. In a paper by Dr. E. W. Allen, chief of the Office of Experiment Stations, U. S. Department of Agriculture, it was shown that if the results of investigation contributed only one dollar per farm each year, in the South the increase would be valued at $3,000,000, or four times the amount that the Southern States appropriate for the stations. In general, the increase in State appropriations for the last few years has been far from commensurate with the increase in salary scales and cost of materials needed for research work. Director F. B. Mumford, of the Missouri Station, spoke of the danger of the stations suffering for lack of funds in the efforts of the States to support the more popular extension enterprises.

In a report of the agronomic committee on coordinating investigational work in the South, two lines of work for cooperative participation were proposed, one on soil fertility and one on corn breeding. The subject of ways and means of getting experimental and extension work before the people was presented by F. H. Jeter, and discussed by J. M. Jones. The more widespread use and distribution of attractive posters and of advertising in the agricultural press was suggested.

W. H. Joyce, of the Federal Farm Loan Board, presented a paper on Financing the Farmers of the South, and C. A. Cobb, editor of the *Southern Ruralist*, one on An Economic Program for the South.

The general session on the final day was devoted to a report of the live stock committee on coordinating investigational work in the South, and to papers by L. C. Gray on Farm Tenancy in the South, E. V. McCollum on Nutrition As It Affects the Welfare of the South, and Miss E. E. Proctor on How Georgia is Attempting to Meet the Needs.

The program also provided for four sections, dealing respectively with field crops and fertilizers, animal husbandry and live stock, extension, and horticulture. Meetings organized as Sections 5, 6, and 7 were also held of the Phytopathological Society, the Association of Cotton States Entomologists, and the Southern Section of the American Society of Engineers. These sectional meetings were well attended, and keen interest is reported in their proceedings.

During the course of the meetings opportunity was given to visit the large tobacco warehouses located in Lexington, and to see the method of conducting the auction sales at one of the largest tobacco centers in the country. An automobile trip was also taken through the blue-grass region of the vicinity. In the evening, the association was the guest of the Hoof and Horn Club of the university, where a "Little International" live-stock show was given.

Officers were elected for the association as follows: President, Dean T. P. Cooper, of Kentucky; vice president, C. A. Mooers, of Tennessee; and sec-

retary-treasurer, J. N. Harper, of Georgia. J. C. Grimes, of Alabama, and T. R. Bryant, of Kentucky, were selected as secretaries of the sections on animal husbandry and extension; and C. D. Matthews, of North Carolina, chairman of horticulture. Officers were also chosen for the various societies in attendance, A. F. Kidder, of Louisiana, becoming chairman, and R. Y. Winters, of North Carolina, secretary of the southern section of the American Society of Agronomy; J. A. Elliott, of Arkansas, chairman, and J. J. Taubenhaus, of Texas, secretary of the Phytopathological Society; W. E. Hinds, of Alabama, chairman, and A. F. Conradi, secretary of the Association of Cotton States Entomologists; and S. F. Morse, of Louisiana, chairman, and C. E. Seitz, of Virginia, secretary of the southern section of the American Society of Agricultural Engineers.

Invitations were extended to hold the next meeting at New Orleans, La., and Gainesville, Fla., decision being left with the executive committee.

International Organization of Agricultural Meteorology.—The 1920 General Assembly of the International Institute of Agriculture at Rome approved a proposal to create a permanent commission of agricultural meteorology, to meet at Rome at the time of meeting of the general assembly, to promote the work of an international organization of agricultural meteorology, with scientific, legislative, and administrative functions, along the lines suggested by the general assembly at its 1911 and 1913 meetings. It is proposed that the members of this permanent commission shall be chosen by the ministers of agriculture of the adhering countries from among meteorologists, agronomists, botanists, phytopathologists, agrogeologists, and malariologists.

The International Institute of Agriculture has issued reports by its vice president, M. Louis-Dop, which discuss in some detail the steps taken by the institute in the past to develop an international service of agricultural meteorology and the proposals of the general assembly for the further development of such a service. It is believed that active cooperation of the various countries in the plan proposed would assure a rapid development of the studies and investigations recently undertaken on the relation between agricultural meteorology and plant physiology, and on the utilization of the results of these studies in the solution of the various problems affecting plant production, thus contributing greatly to the intensification of agricultural production, which is one of the main objects of the work of the institute.

World's Poultry Congress.—Plans are under way for holding this congress under the auspices of the International Association of Poultry Instructors and Investigators at The Hague, September 6 to 13 next. About twenty countries have already arranged to participate in the educational program, the staging of educational and commercial exhibits, and the first international poultry show. One special feature is to be a number of tours conducted by European poultry experts during the two weeks following the congress. J. E. Rice, of Cornell University, is chairman of the U. S. Council of the congress, and is actively engaged in stimulating interest in it in this country.

Experimental Work with Egyptian Plants.—Letters received from Dr. Geo. F. Freeman, botanist of the Société Sultanienne d'Agriculture at Cairo, Egypt, describe in an interesting way the development of his experimental work with a number of typical Egyptian plants. Dr. Freeman went to Egypt from the Arizona Experiment Station about two and one-half years ago, following Dr. R. H. Forbes, who had previously been appointed agronomist to organize experimental work under the Société.

Dr. Freeman writes that, starting two and one-half years ago with a single Egyptian assistant, he now has two assistants of the first class, about ten native assistants of the second class, designated as field observers, a similar

force of laboratory assistants, and three clerks. One of the assistants, a native Egyptian, is a graduate of the National Higher School of Agriculture, and the other, a Roumanian, was formerly assistant to Dr. Aaron Aaronsohn in Palestine. The Société is giving excellent financial support for the work and has recently built a new suite of offices and laboratories, including three offices, a large laboratory for plant physiology, a seed and grain judging laboratory with a floor space of 6,500 sq. ft., and a large warehouse for storage.

Quite extensive work is in progress in the breeding of cotton, wheat, corn, and berseem, and already pure and improved seed of corn and wheat is being grown for distribution. Several promising new races of cotton have been produced, among them a Pima strain with an average lint length of 44 mm. Three types of corn are being produced—an early, a medium, and a late type—with a view to increasing the yield in the first two instances, and to securing types fitted to the different types of rotation in practice and adapting the crop to the time and amount of water supply.

Dr. Freeman mentions that not a single variety of wheat introduced from Arizona or any part of the United States has succeeded in Egypt, all being too late and succumbing to rust. The Egyptian, Australian, and Indian varieties are found much more resistant. Difference in the manner of milling wheat in Egypt from that used in America influences the aim of the wheat breeding work. Three types are being bred: The Beladi (a poulard wheat), a macaroni wheat, and the Hindu or Indian type. He suggests that the Hindu wheat may be worth introducing into the United States, especially the South and Southwest.

An idea of the scale on which this enterprise is carried out may be gained from the statement that in cotton breeding over 500 pure race plats are included, and more than 60,000 pollination bags have been put on for this season's work. The crops are planted and cultivated by a force of laborers under a field foreman, and all detailed field notes are taken by the corps of observers under proper leadership, who also harvest and label the products of small plats or single plants.

The conditions for doing a useful piece of work and carrying on extensive investigations appear to be exceptionally good, and the support and appreciation thus far received are most gratifying.

Miscellaneous.—Plans are under way for opening a new Italian Agricultural Experiment Station in the near future. This station will be located in Bari (Puglia), and will cover the fields of breeding drought-resistant crops, improving fruit trees, dry farming, general research work on genetics, plant physiology, and crop utilization. E. Pantanelli has been appointed director of the station.

The American Farm Bureau Federation is publishing a series of multigraphed Weekly News Letters. According to the first of these Samuel Guard, associate editor of *Breeders' Gazette*, has been appointed director of the federation's department of education and publicity.

B. H. Rawl has resigned as chief of the Dairy Division, U. S. Department of Agriculture, to engage in commercial work in California. Dr. C. W. Larson has been promoted to succeed him.

A department of agriculture has recently been established in Queen's University, Belfast. G. S. Robertson has been appointed lecturer in agricultural chemistry.

A site has been selected for the Tropical Agricultural College of the West Indies on the Government farm at St. Augustine, Trinidad.

EXPERIMENT STATION RECORD.

VOL. 44. ABSTRACT NUMBER. No. 6.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The Bureau of Chemistry of the U. S. Department of Agriculture: Organization, enforcement of Food and Drugs Act, enforcement of Tea Act, research work (*U. S. Dept. Agr., Dept. Circ. 137 (1920), pp. 23, figs. 4*).—This circular gives a brief outline of the organization and function of the Bureau of Chemistry and of the different phases of the regulatory and research work conducted by the bureau.

Chemical publications, W. A. NOYES (*Jour. Amer. Chem. Soc., 42 (1920), No. 11, pp. 2099–2116*).—In this presidential address before the American Chemical Society on September 8, 1920, the author traces the development of chemical publications from the organization of the first national societies about the middle of the seventeenth century to the present time.

The chemists' yearbook, 1920, F. W. ATACK and L. WHINYATES (*London: Sherratt & Hughes, 1920, 5. ed., vols. 1, pp. [6]+422, figs. 10; 2, pp. [2]+423–1136, figs. 14*).—This is the fifth edition of the yearbook previously noted (E. S. R., 43, p. 201). In addition to the usual revisions of a general character, the section on Dairy Products has been revised by G. D. Elsdon and A. D. Heywood, the section on Carbohydrates by F. Robinson, and the section on Physicochemical Constants by G. Barr, B. Scott, and E. G. Wilson.

The proteins and colloid chemistry, J. LOEB (*Science, n. ser., 52 (1920), No. 1350, pp. 449–456, figs. 2*).—In this lecture, delivered before the Harvey Society, October 16, 1920, the author presents evidence that acids and bases combine with proteins in the same way that they combine with crystalline compounds, i. e., that the combination is of a purely chemical character and not to be explained simply on the basis of the adsorption theory.

"The behavior of the proteins therefore contradicts the idea that the chemistry of colloids differs from the chemistry of crystalloids."

The humin formed by the acid hydrolysis of proteins.—VI, The effect of acid hydrolysis upon tryptophan, G. E. HOLM and R. A. GORTNER (*Jour. Amer. Chem. Soc., 42 (1920), No. 11, pp. 2378–2385, fig. 1*).—Continuing the investigation previously noted (E. S. R., 43, p. 111), a study was made of the effect of prolonged boiling with 20 per cent HCl upon the tryptophan molecule with a view to determining whether tryptophan on hydrolysis contributes to the "acid insoluble" or "acid soluble" humins when no aldehydes or other reacting compounds are present. The method consisted in hydrolyzing for 144 hours 0.5 gm. of tryptophan with 100 cc. of 20 per cent HCl. At intervals of 12 hours the hydrolyzate was made up to the original weight by adding sufficient HCl, and the amino nitrogen determined upon a 2 cc. aliquot and tryp-

tophan on 5 cc. of a 1 cc. aliquot diluted to 25 cc., the latter determination being made with the phenol reagent of Folin and Denis.

During the prolonged hydrolysis the color of the solution changed from colorless, through a transparent but dark-red brown, to an opaque black, with the formation after 48 hours of dark amorphous particles of insoluble humin. This increased in amount with prolonged boiling, but after 144 hours only from 4 to 8 per cent of the tryptophan appeared in this form, thus indicating that tryptophan, in the absence of aldehydes or other reactive compounds, contributes but an insignificant fraction of its nitrogen to the acid insoluble humin.

"A much larger amount of the tryptophan appears in the 'soluble humin' after 144 hours' boiling with acid. Since, however, a normal protein hydrolysis rarely requires more than 24 hours' boiling, it appears extremely improbable that the 'total' humin of such a hydrolyzate is derived from tryptophan without the intervention of some other reactive compound, which we have postulated in our earlier papers to be of the nature of an aldehyde."

The nitrogen figures indicate that the nitrogen distribution of tryptophan is altered very markedly by prolonged boiling with 20 per cent hydrochloric acid. It is suggested that probably some of the ammonia of a normal protein hydrolyzate is derived from tryptophan instead of being entirely derived from amid groupings.

Nitrogen and phosphoric acid in the ripening and germination of wheat, E. Rousseaux and Sibot (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 13, pp. 578–580*).—The authors have extended their previous observations on the relation between the soluble and total nitrogen of flour (E. S. R., 38, p. 711) to similar studies, together with determinations of moisture, acidity as H_2SO_4, and total and soluble phosphorus, of samples of grains of wheat obtained every 5 days from the formation of the grain to its harvesting. Determinations were also made of some of the mature grains after sprouting.

The analytical data, which are presented in tabular form, showed the following changes in the composition of the wheat kernel: The total nitrogen varied but little, the lowest figure being 2.1 and the highest 2.68 per cent. The ratio of soluble to total nitrogen, however, showed a steady decrease of from 49 to 9.2 per cent, followed by a gradual increase up to about 14 per cent at maturity, and remaining practically constant at that point if kept under ordinary conditions. On germination a rapid increase in the ratio of soluble to total nitrogen took place, reaching 36 per cent in the whole grain and 52 per cent in the germ itself.

The changes in phosphoric acid corresponded closely to those of the nitrogen, the total acid as P_2O_5 varying from 0.96 to 1.296 per cent, while the ratio of soluble to total P_2O_5 decreased from 76.9 to about 30 and finally became stable at about 35 per cent until germination, when it rose to about 42 per cent. The total acidity as H_2SO_4 showed a steady decrease from 0.3 to 0.016, with an increase on germination to 0.058. The similarity in variations in nitrogen and phosphoric acid is thought to be of practical interest in indicating the necessity of a larger use of phosphate fertilizers along with nitrogenous fertilizers in soils which from lack of soluble nitrogen would tend to impoverish the gluten of the wheat. It is also pointed out that the value of the ratio of soluble to total nitrogen as an index of baking quality of flour is confirmed by these results, since values other than the standard indicate insufficient ripening or a tendency to germination.

Differences in properties of casein from cow's and goat's milk, particularly as regards viscosity, C. Chorower (*Chem. Ztg., 44 (1920), Nos. 99, pp. 605, 606, fig. 1; 100, pp. 613, 614; abs. in Jour. Soc. Chem. Indus., 39 (1920), No.*

19, p. 670A).—Viscosity determinations are reported of cow's milk, goat's milk, and mixtures of the two heated under reduced pressure and then maintained at different temperatures for varying periods of time.

It was found that while in the case of cow's milk it required heating from 30 to 40 minutes at a temperature of from 57 to 58° C. to reach a given viscosity, the substitution of goat's milk for 9 per cent of the cow's milk necessitated heating to 67 or 70° to reach the same viscosity. This difference in properties of the two varieties of milk is explained from a physical standpoint on the ground that in cow's milk the casein is essentally in the form of an emulsoid, while in goat's milk it is a suspensoid.

Properties and constitution of glues and gelatins, R. H. BOGUE (*Chem. and Metall. Engin., 23 (1920), Nos. 1, pp. 5–12, figs. 10; 2, pp. 61–66, figs. 3; 3, pp. 105–109, figs. 4; 5, pp. 197–203, figs. 4*).—This series of investigations of the properties and constitution of glues and gelatins is presented in the following sections: A study of factors influencing viscosity and jell strength, the effect of electrolytes upon degree of dispersion and the structure of gelatin sols, the relation of melting point to viscosity and jell strength, relations between physical properties and chemical constitution, influence of size of molecule upon physical constants, the physical and chemical significance of "craze," on chemical constitution by determination of the groups characteristic of the amino acids, and a study of adhesive properties. An extensive bibliography is appended.

The carbohydrates of the pecan, W. G. FRIEDEMANN (*Jour. Amer. Chem. Soc., 42 (1920), No. 11, pp. 2286–2288*).—An analysis of pecan kernels and a study of the carbohydrates of pecan flour after removal of the oil by extraction with ether are reported from the Oklahoma Station.

The composition of the kernels was as follows: Moisture, 3.75 per cent; ash, 1.7; crude protein, 12.27; crude fiber, 1.71; nitrogen-free extract, 10.81; and ether extract, 69.76. The percentage composition of the nitrogen-free extract of the pecan flour and the percentages of these constituents calculated in terms of the pecan kernel on a moisture-free basis were, respectively, as follows: Sucrose, 9.03 and 1.18; invert sugars, 21.9 and 2.88; araban, 14.82 and 1.95; methylpentosans, 1.68 and 0.22; cellulose (crude fiber), 14.29 and 1.76; amyloid, 4.54 and 0.59; tannins, 2.57 and 0.33; and hemicellulose (dextran), etc., 31.17 and 4.00 per cent.

Cantaloup seed oil, W. F. BAUGHMAN, D. BRAUNS, and G. S. JAMIESON (*Jour. Amer. Chem. Soc., 42 (1920), No. 11, pp. 2398–2401*).—A study of the oil of cantaloup seeds (*Cucumis melo*) received from the Imperial Valley, Calif., is reported from the Bureau of Chemistry, U. S. Department of Agriculture.

The seeds on ether extraction yielded about 30 per cent of oil. On pressing the seeds in the cold in an expeller a pale yellow oil was obtained with a pleasant fruity taste and an odor resembling that of olive oil. The chemical and physical constants of this oil were as follows: Specific gravity, 25°/25° 0.921; refractive index, 20°, 1.4725; iodin number (Hanus), 125.9; saponification value, 192.3; Reichert-Meissl number, 0.33; Polenske number, 0.26; acetyl number, 15.8; acid value, 0.43; unsaponifiable matter, 1.1 per cent; soluble acids (butyric acid), 0.4; insoluble acids, 94; unsaturated acids (determined), 79.2; saturated acids (determined), 15.3; unsaturated acids (corrected), 80.2; and saturated acids (corrected), 14.3 per cent.

Although the iodin number indicated that it might be a semidrying oil, no film developed even after the oil had been exposed to the air on a glass plate for one week. The distribution of fatty acids in the oil in terms of glycerids were as follows: Myristic acid, 0.3 per cent; palmitic, 10.2; stearic, 4.5; oleic, 27.2; and linolic, 56.6 per cent. The oil yielded 1.1 per cent of unsaponifiable matter.

The preparation of lepidin and related bases, L. A. MIKESKA (*Jour. Amer. Chem. Soc., 42 (1920), No. 11, pp. 2396, 2397*).

Isocyanin dyes from lepidin and its homologs, E. Q. ADAMS and H. L. HALLER (*Jour. Amer. Chem. Soc., 42 (1920), No. 11, pp. 2389–2391*).

Synthesis of photosensitizing dyes.—II, Dicyanin A, L. A. MIKESKA, H. L. HALLER, and E. Q. ADAMS (*Jour. Amer. Chem. Soc., 42 (1920), No. 11, pp. 2392–2394*).

Tetramethyl quinolins, L. A. MIKESKA and E. Q. ADAMS (*Jour. Amer. Chem. Soc., 42 (1920), No. 11, pp. 2394–2396*).

An automatic indicator of the moisture content of cereals, M. CHOPIN (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 18, pp. 860–862, fig. 1*).—A device is described and illustrated in which the flour or material to be tested is automatically fed into a cylinder surrounded by a heating jacket and connected with a condenser through which the moisture driven off passes into a graduated cylinder. The amount of water produced in a given time is a measure of the moisture content of the cereal. The chief source of error is considered to be the fact that the material is measured volumetrically instead of gravimetrically, but the error thus caused is thought to be well within the limits of experimental error.

The isolation of proteins from leaves, A. C. CHIBNALL and S. B. SCHRYVER (*Jour. Physiol., 54 (1920), No. 4, pp. XXXII, XXXIII*).—In this preliminary note attention is called to the method of isolating proteins from green leaves described by Osborne and Wakeman (E. S. R., 43, p. 409), and a method is described which differs entirely in principle from this method, the principle employed consisting in treating the disintegrated material with water containing a cytolytic agent and evaporating the colloidal dispersion to flocculation.

Shredded cabbage leaves were extracted with water saturated with ether. On warming to from 40 to 60° C. the opalescent solution resulting, a rapidly settling precipitate was formed which was found to consist chiefly of complex nitrogenous substances. After extraction of lipoids and green pigments with ether a grayish solid was obtained, which on subsequent removal of traces of water-soluble substances could be separated into two approximately equal portions, one soluble in dilute alcohol and the other insoluble in solvents. The latter was found to contain 12 per cent of nitrogen and only slight traces of phosphorus. From the alcoholic solution an amorphous acid could be separated by mineral acids. This contained 11 per cent of nitrogen, 0.7 per cent of phosphorus, and possibly a small amount of nucleoprotein.

The determination of nitrites and nitrates in plant tissue, W. H. STROWD (*Soil Sci., 10 (1920), No. 5, pp. 333–342*).—A report is given of a study of the applicability of various methods of determining nitrates and nitrites to their estimation in plant tissue, as the result of which a procedure is suggested which has been found to give satisfactory results.

The Caron colorimetric method (E. S. R., 27, p. 8), the Zeller method (E. S. R., 21, p. 7), the nitron method, and the technique involving nitrogen determination by the Kjeldahl-Gunning-Arnold method and by the Kjeldahl method modified to include nitrate all proved unsatisfactory. Both the Devarda and Schloesing methods, with proper modifications, gave fairly accurate results. The technique finally adopted was as follows:

"Dilute two equal portions of a cold-water extract of plant tissue to 250 cc. in a Kjeldahl flask. Add a small piece of paraffin and 2.5 gm. of sodium hydroxid in concentrated solution. To one solution add 1 gm. of Devarda's alloy and use the other as a control. Attach to a distilling apparatus at once. Heat under a low flame for 1 hour or until action has ceased, and then distill over

exactly 150 cc. Care should be taken that the determination and the control be distilled at the same rate. Titrate, using 0.0357 N alkali. The difference gives the nitrate plus nitrite nitrogen. . . .

"Treat a similar portion of cold-water extract in a volume of about 25 cc. with about 0.15 gm. of aspartic acid or more, depending upon the amount of nitrite present. The mixture is heated on the water bath for an hour. It is then divided into two equal portions, reduced and distilled according to the Devarda method as given above. The difference between the first and second distillations represents the nitrite nitrogen."

The quantitative estimation of phosphatids, D. H. Brauns and J. A. MacLaughlin (*Jour. Amer. Chem. Soc., 42 (1920), No. 11, pp. 2238–2250*).—An examination at the Bureau of Chemistry, U. S. Department of Agriculture, of various methods for the separation and estimation of phosphatids has led to the adoption of a method involving several processes, including separation of the phosphatids from the other substances in the material to be analyzed and the subsequent determination of phosphorus, cholin, and amino nitrogen in the mixed phosphatids.

The method of drying the sample depends upon the nature of the material. Solids which can be powdered without difficulty are dried in vacuo at the lowest possible temperature. Solids which can not be reduced to powder and solutions in volatile liquids are dried with anhydrous sodium and calcium sulphate according to the method of Robertson (E. S. R., 35, p. 8). Solutions of nonvolatile liquids, such as glycerol, are boiled under a reflux condenser with absolute alcohol for an hour, the excess of alcohol evaporated off, an equal volume of saturated NaCl added to the residue, and the mixture shaken out with successive portions of ether, after which the ether solution is evaporated to dryness. The dry material, as prepared by any of the above methods, is extracted with absolute alcohol in a Soxhlet or other extraction apparatus at a temperature of from 50 to 60° C. for from 10 to 48 hours, after which the extract is dried, extracted with anhydrous ether, and finally shaken out with saturated NaCl. The ether solution is dried and the dried residue weighed and used for the various determinations.

For the determination of phosphorus the destruction of organic matter is effected according to the Neumann method with slight modifications and the phosphorus determined colorimetrically with ammonium phosphomolybdate, using stannous chlorid as the reducing agent. The acid hydrolyzate of an aliquot portion of the phosphatids is used for the determination of cholin as cholin platinum chlorid, from which the weight of lecithin is calculated, and for amino nitrogen by the micro method of Van Slyke. The technique of the various procedures is described in detail and the results are reported of the application of the method to the analysis of different samples of lecithin. The method is thought to be suitable for the analysis of proprietary pharmaceutical preparations, as well as for the quantitative estimation of phosphatids occurring in food products.

Determination of the acidity of gastric contents (*Bul. Johns Hopkins Hosp., 31 (1920), No. 351, pp. 152–166, pl. 1, fig. 1*).—Three papers are presented.

I. *Determination and significance of acidity*, A. T. Shohl (pp. 152–158).—This introductory paper consists of a discussion of the expression and determination of acidity in terms of H-ion concentration and of the significance of pH values in gastric contents.

II. *The colorimetric determination of free hydrochloric acid*, A. T. Shohl and J. H. King (pp. 158–162).—A colorimetric method of determining the free HCl in gastric juice in terms of pH, normality, or in cubic centimeters of N/10 free

HCl per 100 cc. of stomach contents is described, and the results obtained by the use of this method in 50 clinical cases are compared with the results obtained by titration with N/10 alkali, using either Töpfer's indicator or thymol sulphophthalein, or by the electrometric method. A simple color comparator is describe l and illustrated.

III. *Combined acidity and buffer value*, A. T. Shohl and J. H. King (pp. 162–166).—In this paper the authors discuss the significance of buffer action in the gastric contents and describe methods for determining the buffer value of stomach contents by titration, using thymolsulphophthalein as an indicator.

"The procedure in cases showing free HCl is: Add 1 drop or 0.02 cc. of 0.2 per cent thymolsulphophthalein in alcoholic solution for each cubic centimeter of stomach contents. Titrate with N/10 NaOH, free from carbonate, to the full blue color of the indicator. Subtract the value of the free HCl obtained by the colorimetric method from the titration value.

"The procedure in cases showing no free HCl is: Add 1 drop or 0.02 cc. of 0.2 per cent thymolsulphophthalein in alcohol for each cubic centimeter of stomach contents. First titrate the acid deficit by adding N/20 HCl until the orange color appears, or add 1 cc. of N/20 HCl and determine the excess by the colorimetric method. In second sample titrate with N/10 NaOH free from carbonates and thymolsulphophthalein to pH=0.6, the full blue color of the indicator. The sum of the acid deficit and the alkali value equals the buffer value.

"In cases showing free HCl the buffer value is nearly equal to the value of the combined acid, or in cases showing no free HCl to the sum of the acid deficit and the total acidity.

"Determination of the buffer value can be used to determine the amount of HCl secreted by the stomach, the acid value of the contents, and the amount of alkali which the body must furnish to neutralize the stomach contents."

Sugar in the blood: A microchemical method of estimation, R. L. M. Wallis and C. D. Gallagher (*Lancet* [*London*], *1920, II, No. 16, pp. 784, 785*).—The method described is a modification of the revised method of Folin and Wu (E. S. R., 42, p. 712), the principal difference being that instead of using a measured volume of blood, the blood from a finger prick is absorbed on a special piece of blotting paper previously weighed on a torsion balance. When thoroughly soaked with blood (about 150 mg. being absorbed), the paper is rapidly reweighed, inserted in a small test tube, and 3.6 cc. of distilled water added. The extraction is allowed to continue from 30 to 45 minutes, after which 0.2 cc. of the sodium tungstate solution of Folin and Wu is added, followed by 0.2 cc. of 2 N/3 H_2SO_4. The solution is then filtered, 2 cc. of the filtrate placed in the special blood sugar tubes of Folin and Wu, and the determination made in the usual way.

This method is said to yield results identical with those obtained by the macrochemical method of Folin and Wu.

The estimation of chlorids in whole blood, J. B. Rieger (*Jour. Lab. and Clin. Med., 6 (1920), No. 1, pp. 44, 45*).—This is an application, with slight modifications, of the Rappleye technique for the determination of chlorids in blood plasma (E. S. R., 39, p. 807) to their determination in the filtrate obtained by the tungstic acid precipitation of whole blood.

The manufacture of sugar from the cane and beet, T. H. P. Heriot (*London and New York: Longmans, Green & Co., 1920, pp. X+426, pls. 8, figs. 31*).—In this treatise on the manufacture of cane and beet sugar, which is one of the monographs on industrial chemistry edited by E. Thorpe, the arrangement of subject matter is such as to enable the student of sugar technology to follow the two industries (beet sugar and cane sugar) side by side, noting the progress

in each and the differences in practice which have arisen from the differences in the raw materials or, if desired, to follow the consecutive operations in either industry. This has been accomplished by treating the two industries in separate parts or in separate chapters under the same general heading. The main subdivisions of the book are as follows: The raw materials, extraction of juice from the cane, extraction of sugar from the beet, composition of cane and beet juices, treatment of cane and beet juices, evaporation of water from the juice, crystallization, special methods of extracting sugar from molasses, by-products, and refining of cane and beet sugars.

Beet sirup, its manufacture, valuation, and use, B. BLOCK (*Rübensirup, seine Herstellung, Beurteilung und Verwendung. Leipzig: Otto Spamer, 1920, pp. VIII+146, pl. 1, figs. 68*).—This is a handbook on the manufacture and analysis of sugar beet sirup.

METEOROLOGY.

Agricultural meteorology.—The effect of weather on crops, J. W. SMITH (*New York: Macmillan Co., 1920, pp. XXIV+304, pls. 8, figs. 88*).—This book is notable as "the first text on the subject of agricultural meteorology that has ever been prepared." It is designed primarily for university and college students, but is believed to be practicable for agricultural high schools and farmers' reading courses and also of interest generally to individuals desiring information regarding the relation of climate to crops.

The text is an outgrowth of the author's long experience as observer and teacher. In its preparation he had recourse to articles and papers by ecologists, botanists, plant physiologists and pathologists, entomologists, and the like. Especially valuable features are the well-chosen exercises and practicums and the select list of references to literature on the subject at the end of each chapter

The book defines clearly and puts in form for pedagogic usefulness at an opportune time a subject which has heretofore had a rather uncertain status and has been neglected in schools and colleges largely because of the lack of suitable texts. It includes brief but clear and simple expositions of the essential but heretofore scattered and undigested information on the effect of weather on the growth and yield of crops; the influence of climate and weather on insect activities and the development of plant diseases; and the protection of crops, animal life, and birds from damaging meteorological phenomena. The relation of climate to crop distribution and farm operations is also discussed, and the effect of different weather factors on the yield of cotton, corn, wheat, oats, rye, potatoes, tobacco, fruit, and other crops is treated in detail.

The first chapter deals briefly with introductory meteorology, including some of the elementary and fundamental facts and principles necessary to an intelligent understanding of the subject. Succeeding chapters discuss agricultural meteorology, agricultural climatology, correlation, climate and crops, climate and farm operations, weather and crops, the effect of weather on the yield of grains, the effect of weather on vegetables and miscellaneous crops, weather forecasts and warnings, frost and the protection of crops from frost damage, and value of lightning rods.

Incidentally, the book emphasizes the fact that while weather and crop yield data are abundant and easily obtained, there is great need of more systematic phenological observations and of such data as can probably be best secured by agricultural and meteorological stations in connection with the agricultural experiment stations in the principal crop-growing areas.

The book is one of the Rural Textbook series, edited by L. H. Bailey.

Air pressure distribution, wind, and precipitation in northern and middle Europe, with comments on the relation of these climatic elements to agriculture, W. R. ECKART (*Landw. Jahrb., 50 (1917), No. 4, pp. 585–616, figs. 13*).—This article deals briefly with pressure, wind, and precipitation conditions in France, Belgium, and the British Isles, and more in detail with such condition in Scandinavia and middle and eastern Europe. The agricultural relations and applications of the subject are very briefly touched upon.

Certain considerations relating to rainfall, springs, and dry farming, ALQUIER (*Bul. Agr. Algérie, Tunisie, Maroc, 2. ser., 26 (1920), No. 10, pp. 209–215*).—Climatic and soil conditions in Algeria, Tunis, and Morocco, with special reference to the successful practice of dry farming in these countries, are briefly discussed.

Ozone, forest air, and weather, H. FISCHER (*Naturw. Umschau Chem. Ztg., 9 (1920), No. 10, pp. 145–147*).—Observations are reported which show that no rain occurred during 1920 in the forest where the observations were made that was not preceded by distinct evidence (odor) of an increased ozone content of the air.

Weather reports [for Alaska, 1919], C. C. GEORGESON ET AL. (*Alaska Stas. Rpt. 1919, pp. 80–90*).—Tabular summaries are given of observations on temperature, precipitation, and cloudiness at 39 Weather Bureau stations in Alaska.

Seasonal conditions at Langdon [N. Dak.], P. F. TROWBRIDGE (*North Dakota Sta. Bul. 134 (1920), pp. 3–7*).—The main characteristics of the growing seasons of 1914 to 1919, inclusive, at the Langdon Substation are briefly described and tables are given which show the frostless period, maximum, minimum, and average temperatures, and rainfall.

SOILS—FERTILIZERS.

The value of soil analysis, J. A. VOELCKER (*Jour. Bath. and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 76–84*).—In this discussion the author disagrees with other authors on the subject that soil analysis is of secondary importance in agronomy. He concludes that there are two essentials in a soil analysis, namely, extreme accuracy and experience in interpreting the results. "There is probably no branch of agricultural analytical work that requires alike more accuracy in making the actual determinations or more care in framing one's conclusions."

Sampling field soils, A. E. VINSON, C. N. CATLIN, and S. W. GRIFFIN (*Arizona Sta. Rpt. 1919, pp. 405, 406*).—Work relating to the proper sampling of field soils, with special reference to alkali soils, indicates that single field samples are usually of little value.

Analyses of samples of the first and second foot of an apparent black alkali soil, taken with the soil auger, showed no black alkali but a fair amount of gypsum. A square yard of this soil was removed with trowels in 2-in. layers to the depth of 2 ft. and each layer analyzed. It was found that the surface layer was weakly of the gypsum type, changing into black alkali in the third and fourth inch. The black alkali increased to a maximum at the eighth inch, then decreased, and the soil again was of the gypsum type at the sixteenth inch.

The flocculation of soils, N. M. COMBER (*Jour. Agr. Sci. [England], 10 (1920), No. 4, pp. 425–436*).—Experiments conducted at the University of Leeds on the flocculation of neutral and alkaline suspensions of clay, silt, and soil by calcium salts are reported. The materials included a clay soil, a silt soil containing a large amount of organic matter, silt soil consisting of coarse and fine silt, silt loam and medium loam soils, light and heavy soils, and a clay subsoil,

It was found that silt, like most insoluble substances, when suspended in water was most easily flocculated by calcium salts if the suspension was neutral. The addition of alkali stabilized the suspension and rendered flocculation more difficult. Soil clay behaved in an opposite manner, and was precipitated from alkaline suspensions more readily than from neutral suspensions. In this respect it resembled silicic acid and other so-called emulsoid colloids, and it is suggested that the clay particles are protected by such colloids and thus behave as an emulsoid. If this is true the action of lime is considered to be in accordance with the facts of colloid chemistry.

Experimental evidence is advanced to support the view that clay as an emulsoid protects the larger particles which by themselves are suspensoids. The soil aggregates are conceived as having large nuclei surrounded by particles which become smaller from the center outward, the clay ultimately imposing its emulsoid nature on the whole aggregate and on the whole soil in normal cases. Fine silt soils are not flocculated by calcium hydroxid on account of the inefficiency of the relatively small amount of emulsoid clay to protect the large suspensoid surface exposed by the fine silt.

The reclamation of waste land (*Jour. Roy. Agr. Soc. England, 80 (1919), pp. 95–133*).—An outline of the general problem of the reclamation of waste land in Great Britain is given by W. Gavin. The main areas of reclaimable land are salt marshes, sandy heaths, upland moors, moors and downs at less than 1,000 ft. elevation, low-lying bogs, bushed land, and sand dunes. The probable area reclaimable for agricultural purposes in England is suggested to be about 250,000 acres.

The scientific and technical problems relating to the reclamation of waste land in England are discussed by E. J. Russell, as a contribution from the Rothamsted Experimental Station. The discussion is confined to sand and clay soils, the former constituting the chief part of the waste land of the eastern half of England.

Reclamation of alkali, A. E. Vinson, C. N. Catlin, and S. W. Griffin (*Arizona Sta. Rpt. 1919, pp. 406, 407*).—Analyses of originally alkaline soils reclaimed by leaching are reported, indicating, among other things, the completeness with which white alkali may be leached and the tenacity with which black alkali resists leaching.

Comparison of salt lands in the Deccan and in Sind, V. A. Tamhane (*Agr. Jour. India, 15 (1920), No. 4, pp. 410–417*).—A discussion is given of the formation and origin of the salt lands of the Deccan and Sind. Analyses of the alkalis are reported, indicating that those of the Deccan contain a comparatively large proportion of sodium sulphate, while in the soils of Sind sodium chlorid predominates over all the other salts. It is noted that the black alkali of the soils of Sind does not contain sodium carbonate as a necessary constituent, although the characteristic black appearance of the surface soils is in evidence.

Smoke injury in soils, W. Leiningen-Westerburg (*Centbl. Gesam. Forstw., 46 (1920), No. 5–6, pp. 129–144*).—A number of experiments on the injurious action of industrial smoke and dust on vegetation are reported. These led to the conclusion that such injury is not simply a chemical or botanical problem, but that the effect of these materials on soils is of considerable indirect importance and should always be taken into account in such studies.

Depth of plowing trials, P. F. Trowbridge (*North Dakota Sta. Bul. 134 (1920), pp. 22, 23*).—Depth of plowing trials begun in 1910, conducted in connection with a 6-year rotation of corn, wheat, barley, timothy and clover, wheat, and oats, are reported.

Each crop was grown each year on from 5 to 6-in. fall plowing, 12-in. fall plowing, and from 3 to 4-in. spring plowing. Three to 4-in. fall plowing and 5 to 6-in. spring plowing were also added in the second and fifth years, respectively. It is noted that the cost of plowing 12 in. deep is about three times the cost of plowing from 5 to 6 in. deep.

The results suggest that the effects of the 12-in. fall plowing are cumulative, as the last three years showed markedly increased yields. Corn soil was found to be generally better than timothy sod for wheat production, the best results being obtained with deep fall plowing. The results with oats were progressively in favor of the deep fall plowing, and shallow spring plowing gave, in general, the poorest returns. This was also generally true for barley and in the majority of cases for timothy hay. While the largest results with peas for hay after wheat and oats were obtained with deep fall plowing, shallow and medium spring plowing yielded relatively good results.

The genesis of a fertile soil, J. B. Harrison and C. B. W. Anderson (*West Indian Bul., 18 (1920), No. 3, pp. 77–98*).—This paper reports a rather detailed chemical and mineralogical study of the origin of the soils of the Barbados.

It is concluded that the high-level Barbados soils have originated from the weathering of limestone, from air-borne volcanic minerals, from ferruginous clay, which was held in colloidal suspension or solution in the ocean waters, and also from argillaceous and limonitic materials, contributed by the weathering of the globigerina marls, and foraminiferal limestones. The origin of the low-level chocolate and black soils is considered to be similar, but they also contain detrital matter. The very sharply angular outlines of the minerals separated from the corals indicate that these minute fragments have undergone very little changes, while those isolated from pothole clay show that since their liberation from the limestone the minerals have undergone weathering and lateritic changes resulting in the production of very finely divided ferruginous clay.

Plant food and soil management, C. A. Whittle et al. (*Atlanta, Ga.: South. Fert. Assoc., Soil Impr. Com., pp. 47, figs. 11*).—This is a brief popular exposition of soil requirements and the methods by which plants are nourished.

I, Report on soil experiment fields.—II, Maintenance of fertility, G. Roberts and A. E. Ewan (*Kentucky Sta. Bul. 228 (1920), pp. 86–131*).—This bulletin is in two parts.

Part 1 reports a continuation and extension of studies at several experimental farms in Kentucky on the fertilizer and manurial requirements of the soil and on crop rotations and adaptations (E. S. R. 35, p. 121). Special attention is paid to the crop-producing value of commercial fertilizers where as much manure was used as could be produced from the crops grown. The London and Burnside fields were discontinued, and new fields were established at Farlston and Campbellsville.

It is considered evident that with certain exceptions the fertilization of ordinary farm crops is not profitable on the soil at the Lexington field. The chief requirement of this soil is the maintenance of organic matter and nitrogen. It is stated that productiveness may be maintained without the use of farm manure provided all residues in rotations are saved and returned with cover crops. The use of lime is also considered necessary for the successful growth of alfalfa and sweet clover.

The results from fertilizing tobacco on this field "indicate that under some conditions in the central blue-grass region it is profitable to fertilize this crop heavily with fertilizers containing high percentages of nitrogen and potash in addition to phosphate. When there is not a good grass or clover sod to be used

for tobacco or where there is not a sufficient amount of manure, such fertilization will very likely be profitable."

On the experiment fields outside the central blue-grass region the results indicate the great necessity for supplying both limestone and phosphate in some form. The yields obtained where both materials are applied are much greater than where either one is used alone.

The results obtained on the fertilization of tobacco at Greenville, Russellville, and Mayfield also indicate that it is profitable to fertilize liberally with nitrogen and potash in addition to phosphate, especially when the soil is not in a high state of fertility. Sodium nitrate can be profitably used as a top-dressing for wheat in some cases, especially where wheat follows corn, but it should never be used unless the soils are highly phosphatic or phosphate has been used. Ammonium sulphate may be substituted for sodium nitrate, but it is considered much better to depend upon a large use of legumes, crop residues, and manure for nitrogen and potash than to supply these from commercial sources.

Part 2 gives general information on the maintenance of soil fertility.

Fertility studies [at the Langdon, N. Dak., Substation], P. F. TROWBRIDGE (*North Dakota Sta. Bul. 134 (1920), pp. 11–17, fig. 1*).—Fertility studies begun in 1913 on a 4-year rotation of corn, wheat, barley, and field peas, which included a grain and a live-stock system, are described.

In the grain system the peas were plowed under for green manure, while in the live-stock system the plan was to maintain the organic matter and nitrogen content of the soil by growing peas and returning the manure to the soil. The fertilizers used were steamed bone meal at the rate of 300 lbs. per acre, ground limestone at the rate of 1 ton per acre, potassium sulphate at the rate of 400 lbs. per acre, and manure at the rate of 8 loads per acre. During the six years of the studies only two corn crops were harvested, the others being failures.

The live-stock system showed an average advantage for four years of 2.03 bu. of wheat per acre over the grain system. In both systems the best results were produced with phosphorus and lime. The grain-farming system showed a slight average advantage over the live-stock system for barley, and in both systems the best average results were obtained with phosphorus, lime, and potassium.

Nitrogen from the air, J. G. HUTTON (*South Dakota Sta. Soil Survey Circ. 1 (1920), pp. [4]*).—This circular constitutes a brief popular argument for the growth of leguminous crops to increase the nitrogen supply of the soil.

Straw utilization, R. B. DUSTMAN (*Ohio State Univ., Timely Soil Topics, No. 31 (1920), pp. [4]*).—This leaflet contains an argument for the incorporation of straw in the soil, it being pointed out that straw not only carries considerable amounts of nitrogen and potassium but that it is of considerable value to soil on account of the organic matter added.

Studies in biochemical decomposition of cow dung and urine in soil, N. V. JOSHI (*Agr. Jour. India, 15 (1920), No. 4, pp. 398–409, pls. 8*).—Laboratory experiments with cow dung, sheepfold manure, and urine are reported, showing that nonnitrogenous materials like cellulose lower the amounts of nitrates formed from the organic manures in which they are present in a fairly large proportion.

Urine was found to give the greatest amount of nitrates of the three materials whether in fresh condition or when fermented under aerobic or anaerobic conditions, so that it can be used immediately or after keeping. If exposed to air, however, it lost some of its nitrogen. Cow dung did not nitrify in fresh condition; it improved by storage and became nitrified after storage under

both aerobic and anaerobic conditions. The results with sheep manure indicate that mixture of manure and urine in the manure pit is not desirable from the standpoint of nitrate formation, and also on account of the possibility of greater losses of nitrogen. The two processes of nitrification and of carbon dioxid production did not seem to be related. The experiments are to be continued.

Value of manure in [five-year and six-year rotations], P. F. Trowbridge (*North Dakota Sta. Bul. 134 (1920), pp. 17-21, figs. 2*).—In an experiment begun at the Langdon Substation in 1911 with a rotation of corn, wheat, barley, clover, and wheat, the even-numbered plats were manured in the fall on the wheat stubble preceding the corn crop, at the rate of 10 loads of barnyard manure per acre. Wheat after corn, and barley and wheat after clover, showed an appreciable average gain as a result of manuring. The clover gain of two years exactly balanced the loss of three years, and half of the corn crops were failures.

In an experiment begun in 1910 with a rotation of corn, oats, wheat, timothy and clover, timothy and clover, and wheat, the manure was applied at the rate of 10 loads per acre once in six years in the fall just previous to the corn crop. An average gain for the entire period was obtained with all crops, although three failures occurred in the case of corn due to frost. Each load of manure showed a value of $2.18 in increased crop value.

Modern methods for experiments with fertilizers and manures, J. Sebelien (*Jour. Agr. Sci. [England], 10 (1920), No. 4, pp. 415-419*).—In this paper, a contribution from the Agricultural University, Aas, Norway, the methods used in field experiments at the university are described.

In these methods the heterogeneity of the soil is regarded as a thing to be recognized and not evaded. The variations of the soil are measured by a great number of control plats adjacent to each of the trial plats, it being the opinion that even if the different parts of the field lack uniformity the disadvantage will be thus annulled. The mean error of the results is then obtained from the parallel differential values by the method of least squares. The greatest degree of accuracy was found to be given by plats of from $\frac{1}{320}$ to $\frac{1}{610}$ acre. For practical reasons, however, plats from $\frac{1}{120}$ to $\frac{1}{260}$ acre are generally used in Norwegian field experiments.

Pot culture experiments, 1919, J. A. Voelcker (*Woburn Expt. Sta. Rpt. 1919, pp. 15-23, pls. 4; also in Jour. Roy. Agr. Soc. England, 80 (1919), pp. 430-438, pls. 4*).—Experiments to determine the action of arsenious acid, arsenic acid, sodium arsenite, and sodium arsenate on wheat, when added in amounts supplying the element arsenic in percentages varying from 0.001 to 0.1, showed that the injurious action of arsenic depends upon the solubility of the compound in which it is added. With insoluble forms like arsenious acid, the highest concentrations were used without injury to the germination or crop. The more soluble compounds, such as arsenic acid or sodium arsenite and arsenate, decreased the crop when the element arsenic was added in amounts up to 0.02 per cent, and caused the crop to fail when 0.05 per cent of arsenic was added. Soluble arsenic added up to the amount of 0.05 per cent retarded germination, and 0.1 per cent entirely inhibited it. The limit of safe use appeared to be 0.01 per cent of arsenic, representing an application of about 825 lbs. of arsenic acid per acre.

In experiments to determine the relative effects of caustic lime and calcium carbonate on barley when applied in amounts of 1, 2, 3, and 4 tons per acre, the two materials behaved very differently. The caustic lime was immediately active while the calcium carbonate appeared to be inactive. These experiments are being continued.

A comparison of the values of ammonium sulphate, sodium nitrate, ammonium nitrate, calcium nitrate, and granular calcium cyanamid as sources of nitrogen for barley showed that the best results were obtained with sodium nitrate, the granular calcium cyanamid being by comparison strikingly ineffective. Ammonium sulphate did not give as good results as the other nitrates. Further experiments showed that it made little difference whether ammonium sulphate was applied to crops as a solid or dissolved in water.

Experiments with leather powder and leather treated with sulphuric acid to compare its fertilizing value with that of rape dust, dried blood, and shoddy showed practically no crop increases with the leather and shoddy as compared with rape dust and dried blood.

Fertilizer experiments [at Kodiak Station], W. T. White (*Alaska Stas. Rpt. 1919, p. 56*).—Experiments on 1-acre plats on volcanic ash soil showed that 10 tons of manure per acre increased the hay yield of oats and peas 11 per cent, while 10 tons of stable manure plus 125 lbs. of sodium nitrate increased the yield 15 per cent.

A second experiment with oats, in which 8 tons of stable manure were used, showed that the use of sodium nitrate at the rate of 125 lbs. per acre was of no additional advantage.

How to convert sugar-cane megass into a profitable manure, K. Adinarayana Rao (*Jour. Madras Agr. Students' Union, 8 (1920), No. 7, pp. 184–189*).—Preliminary experiments on the bacterization of sugar-cane megass for the production of an available nitrogenous fertilizer are briefly reported.

Samples of the materials were dried and inoculated with Azotobacter, Radicicola, and Clostridium. It was found that the material contained from 1.2 to 1.4 per cent of nitrogen after being acted upon by the nitrogen-fixing organisms for two months. The decomposition of cellulose was more pronounced where pure cultures of cellulose-decomposing organisms were introduced. The experiment is being continued.

Leather as a manure (Lansome Field), 1919, J. A. Voelcker (*Woburn Expt. Sta. Rpt. 1919, pp. 12, 13; also in Jour. Roy. Agr. Soc. England, 80 (1919), pp. 427, 428*).—Field experiments to compare ground leather powder and treated leather with ammonium sulphate as sources of nitrogen showed that neither the ground nor treated leather had any effect on the crop of swedes.

The Salton Sea, A. E. Vinson, C. N. Catlin, and S. W. Griffin (*Arizona Sta. Rpt. 1919, pp. 412–414*).—Eleven complete analyses of Salton Sea water are reported and discussed. It is noted that calcium carbonate, potassium, and phosphorus have been disappearing from this water. The lost calcium carbonate and most of the phosphorus have been accounted for in the formation of tufa, but only 3 per cent of the potassium lost can be accounted for in that way. It is the opinion that the lost potassium unaccounted for must have been adsorbed.

Sodium compounds in 1919, R. C. Wells (*U. S. Geol. Survey, Min. Resources U. S., 1919, pt. 2, pp. 47–76*).—This report on the production, sale, and utilization of sodium compounds, mainly in the United States, during 1919 contains brief sections on sodium nitrate and cyanid and niter cake.

Investigations on the action of ammonium humate, O. Lemmermann and H. Wiessmann (*Fühling's Landw. Ztg., 69 (1920), No. 15–16, pp. 281–289*).—Studies on the action of so-called ammonium humate, which is the product of the treatment of liquid manure with brown coal, are reported, the purpose being to compare it with ammonium sulphate as a source of nitrogen.

The ammonium humate used contained 5.74 per cent of total nitrogen and 4.02 per cent of ammonia nitrogen. The tests were conducted on an unproduc-

tive loamy sand soil, a productive humus sand soil, and a swamp soil containing clay and humus. All three soils were acid.

It was found that surface applications of 50 kg. of total nitrogen per hectare (44.5 lbs. per acre) in the form of ammonium humate gave as good results with grain as 50 kg. of ammonia nitrogen in the form of ammonium sulphate. The ammonium sulphate gave the better results when both fertilizers were incorporated more deeply. An application of 100 kg. of nitrogen per hectare in the form of ammonium sulphate had an apparently injurious influence on crops, which is attributed partially to its physiologically acid character. Better results were obtained from the same soil with an application of 100 kg. of nitrogen per hectare in the form of ammonium humate. The three soils varied greatly in productivity and reacted differently to the two fertilizers, with special reference to the ratio of grain to straw.

Experiments with nitrogenous top-dressings (Road Piece Field), 1919, J. A. Voelcker (*Woburn Expt. Sta. Rpt. 1919, p. 11; also in Jour. Roy. Agr. Soc. England, 80 (1919), p. 426*).—Field experiments to compare sodium nitrate, ammonium sulphate, ammonium nitrate, calcium nitrate, and calcium cyanamid as sources of nitrogen showed the best results from sodium nitrate, followed in order by ammonium sulphate and ammonium nitrate. The poorest results were given by calcium cyanamid.

The reactions taking place in cyanamid when used in mixed fertilizers, W. S. Landis (*Amer. Fert., 54 (1921), No. 2, pp. 49–55*).—Considerable data on the subject are summarized, leading to the conclusion that cyanamid in mixtures with acid phosphate, potash salts, sodium nitrate, and ammonium sulphate is converted mainly to carbamid and in lesser degree to guanylurea if not over 60 lbs. of cyanamid is added to a ton of mixed fertilizers. Where this precaution has not been followed, there is a possibility of finding a small quantity of dicyandiamid just after mixing, which disappears in a few weeks. It is the opinion that a period of only a few days' duration between the mixing and the analysis of an improperly prepared fertilizer is insufficient to draw conclusions as to the dicyandiamid content of any such mixture.

Phosphated manure, M. A. Bachtell (*Ohio State Univ., Timely Soil Topics No. 30 (1920), pp. [4]*).—On the basis of results obtained in experiments at the Ohio Experiment Station, the use of either acid or rock phosphate with manure is advocated. The work at the station has shown that these combinations give better results than either material used alone on Ohio soils. No particular preference for either phosphate is indicated, it being stated that the use of 40 lbs. of either phosphate per ton of manure gives good results.

Potash in 1919, W. B. Hicks and M. R. Nourse (*U. S. Geol. Survey, Min. Resources U. S., 1919, pt. 2, pp. 77–94*).—Data are reported on domestic and foreign production, exports, and imports of potash during 1919, together with a list of patents for processes of extracting potash from silicate rocks.

During the year 110,243 short tons of potash-bearing materials were produced in the United States, having an approximate average content of potash of nearly 28 per cent. This was equivalent to a total content of 30,845 short tons of potash, valued at $7,836,873. The production from the alkali lakes of western Nebraska continued to exceed that from any other one region or source. Of the total production of potash during the year, natural brines from localities other than western Nebraska yielded 36.6 per cent, Nebraska brines 29.2, waste water from sugar refineries 11.7, molasses distillery waste 9.1, alunite 7.4, dust from cement mills 3.8, wood ashes 1.2, and silicate rocks, kelp, and blast-furnace dust 1 per cent. Crude mixed salts constituted 50.8

per cent of the potash produced during the year, muriate 34.1, sulphate 7.8, cement mill and blast-furnace dust 2.2, and other materials 5.1 per cent. California produced 41.5 per cent of the total output during the year, Nebraska 29.2, Utah 16.3, and other States 13 per cent.

A bibliography is appended.

French potash, H. von Feilitzen and I. Lugner (*Svenska Mosskulturför. Tidskr., 34 (1920), No. 5-6, pp. 351-356*).—Comparative analyses of samples of Alsatian and German 20 and 50 per cent potash salts showed that the Alsatian 20 per cent salt contained only slightly more potassium chlorid than the German salt, considerably more sodium chlorid, and not nearly as much soluble magnesia. The 50 per cent German salt contained more potassium chlorid than the Alsatian salt and less sodium chlorid. Mixtures of superphosphate with the German and Alsatian 20 per cent salts showed practically no reversion of the superphosphate after storage for one week.

The use of potash salts, J. Hughes (*Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919-20), pp. 7-20*).—Considerable experimental data obtained from different sources, especially in England and Scotland, are summarized to indicate the proper use of potash salts on different crops.

It is concluded that since potash is not essential to the formation of flesh and bone, it is not necessary to apply it to permanent pasture. A fall dressing of 200 lbs. of kainit salts per acre may be applied with advantage to clover. Potash salts are not required for cereals, such as wheat, barley, oats, and rye, and will not pay when used on beans and peas when there is plenty of lime in the soil. Potash may be applied with advantage to potatoes, but may be economically omitted from the treatment of hops and mangolds provided plenty of stable manure and sodium nitrate is used. For tomatoes, potassium nitrate used in combination with superphosphate and ammonium sulphate gives good results.

Comparative experiments with 37 per cent potash salts and kainit, P. Bolin (*K. Landtbr. Akad. Handl. och Tidskr., 58 (1919), No. 6, pp. 323-331*).—Five years' experiments on the value and economy of 37 per cent potash salts as compared with kainit are reported. The experiments included 324 separate tests and were conducted on peat soils in 15 Swedish provinces. The two fertilizers were applied in equal amounts by weight and in amounts supplying equal percentages of potash to hay, beets, cabbage, potatoes, oats, and turnips.

Both fertilizers increased crop yields, but kainit gave greater average increases than the more concentrated salt when used on the equal potash percentage basis. The differences in increased yield varied widely, which is attributed to the variable physical and chemical compostion of the soil. The superiority of the kainit when supplying an equal amount of potash to that supplied by the 37 per cent salt is attributed to its content of materials other than potash.

On the basis of these results and the charges for freight and other factors, it is estimated that kainit is one-third cheaper than the 37 per cent salt, if the value of a unit weight of potash is the same in both fertilizers.

The importance of potassium-magnesium sulphate for moor cultivation, A. Jacob (*Mitt. Ver. Förd. Moorkult. Deut. Reiche, 38 (1920), No 21, pp. 339-344*).—Two years' experiments to compare potassium-magnesium sulphate, a by-product from the manufacture of potassium sulphate, with other potassium fertilizers on potatoes in moor soils in different parts of Germany are reported.

It was found in both years that potash fertilizers produced considerable increases in the yield of potatoes, which is not considered unusual in moor soils.

The salts free of chlorin, such as potassium sulphate and potassium-magnesium sulphate, gave considerably better results than the potash salts containing chlorin, such as potassium chlorid. The magnesium content of the potassium-magnesium sulphate did not increase the total yield of potatoes, but apparently increased the starch content. While the potassium-magnesium sulphate is somewhat more expensive than potassium sulphate, it is thought that the former fertilizer should be used to a greater extent on the moor soils of Germany and Holland.

Sources of agricultural liming materials, R. C. Collison (*New York State Sta. Bul. 478* (*1920*), *pp. 14*).—This bulletin gives brief information on the agricultural use and comparative cost of liming materials, and includes a list of producers of liming materials in New York State. The subject is covered more in detail by Bulletins 400 and 430 of the station, previously noted (E. S. R., 33, p. 26; 37, p. 523).

Gypsum in 1919, R. W. Stone et al. (*U. S. Geol. Survey, Min. Resources U. S., 1919, pt. 2, pp. [2]+99–113*).—Data are reported on the production, mining, milling, and imports and exports of gypsum during 1919.

It is stated that 2,420,163 short tons of gypsum were mined in 1919, which was an increase of 18 per cent over the output in 1918. The total value of the crude and calcined domestic gypsum sold in 1919 was $15,727,907, or an increase of 37 per cent over the total value in 1918. Practically 50 per cent of the gypsum sold for agricultural purposes was produced in Virginia, New York ranking second, and Iowa third. The average price per ton of all agricultural gypsum sold in the United States increased from $3.96 in 1918 to $4.64 in 1919. There was a very marked decrease in quantity used, however.

An article on agricultural gypsum and its uses, by W. Crocker, is included.

Injury to crops by borax, J. K. Plummer and F. A. Wolf (*N. C. Dept. Agr. Bul., 41* (*1920*), *No. 15, pp. 20, figs. 8*).—Pot culture studies with corn and cotton on clay loam and cotton and tobacco on sandy loam soils, to determine the influence of borax, agreed with field observations in showing that plants are more susceptible to injury by borax on the lighter soils.

In sandy soil as little as 1 lb. of anhydrous borax per acre injured tobacco, and no cotton grew in any pots containing over 5 lbs. per acre. In clay soil both cotton and corn showed marked injury when the amounts of borax exceeded 7 lbs. of anhydrous borax per acre, but the plants survived in these series. The tobacco plants which were poisoned in the third transplanting gradually recovered and after two months were apparently normal, thus presenting a condition similar to that observed in the field. The corn plants on sandy soil, to which borax at the rate of 5 lbs. per acre was applied, showed considerable injury, whereas with an application of 10 lbs. per acre they were entirely lacking in green color and soon died.

There was no indication that borax will remain in the soil and injure subsequent crops. It was found that borax disappeared from the root zone by leaching, chemical combination, and absorption.

Commercial fertilizers, H. E. Curtis, W. Rodes, and H. R. Allen (*Kentucky Sta. Bul. 224* (*1919*), *pp. 259–372*).—This bulletin contains the results of actual and guarantied analyses and valuations of samples of 780 brands of fertilizers and fertilizer materials collected for inspection in Kentucky during 1919. These included 351 brands of complete fertilizers, 117 acid phosphates, 175 nitrogenous superphosphates, 68 acid phosphate and potash mixtures, 68 bones, tankage, and nonacidulated bone and potash mixtures, and 1 sample of ammonium sulphate.

AGRICULTURAL BOTANY.

The ecological basis of organization in plants, A. Borzi (*Riv. Biol., 1 (1919), No. 2, pp. 181–212, figs. 6*).—Evidence is discussed as bearing upon the claim that every feature of a plant is a determinate ecological expression of the nature and the mode of action of the relations of the plant with its environment.

Heredity studies on the reversion of a race of plantain, S. Ikeno (*Rev. Gén. Bot., 32 (1920), No. 374, pp. 49–56*).—An account is given with descriptive discussion of crossings and mutations in *Plantago major.* This is to be followed by a more detailed account.

The families and genera of the bacteria, C. E. A. Winslow, J. Broadhurst, R. E. Buchanan, C. Krumwiede, jr., L. A. Rogers, and G. H. Smith (*Jour. Bact., 5 (1920), No. 3, pp. 191–229*).—This is a final report of the committee previously noted (E. S. R., 37, p. 819), revised in certain particulars and supplemented by an index of genera showing where the commoner bacterial species should be placed.

Regarding the method of defining bacterial genera, the committee agreed with the views of the Botanical Society of America, as previously reported by Hitchcock (E. S. R., 42, p. 128), which preferred the use of type species with proper literature references, but it favored the inclusion also of brief characterizations of the genera themselves. In view of the uncertainty which surrounds the description of many bacterial species, tentative characterizations of the genera presented were included in section 3 of the report. Changes are detailed which appear in the report as compared with that of 1917.

A short section is devoted to the specific recommendations made by the committee. This is followed by the suggested outline of bacterial classification, a key to the families and genera of the Actinomycetales and Eubacteriales, for which a modified arrangement is proposed, and a generic index of the commoner forms of bacteria, which is intended only to show how the names of species as commonly found in the literature should be changed to correspond to the generic classification suggested by the committee. The report contains also a bibliography of about 70 titles.

The quantitative determination of photosynthetic activity in plants, F. L. Long (*Physiol. Researches, 2 (1919), No. 6, pp. 277–300*).—This paper reports an investigation endeavoring to find a rapid and satisfactory chemical method of determining photosynthetic activity in different plants and plant parts under different sets of conditions or at different times. Of the various methods tested the one here used alone proved satisfactory. This method is thought to be valuable for such work and perhaps the most reliable yet devised for the determination of carbohydrates when present in small quantities.

In order to test this method as to its ecological use, determinations of photosynthetic activity were made for plants under a variety of habitat conditions. An indication of the general behavior of plants in the formation of carbohydrates was obtained by a series of determinations for healthy leaves of Phaseolus, made at different hours of the day. The amount of carbohydrates increased gradually from early in the morning until an hour past noon, relatively high activity continuing until 4 p. m., when a rapid decrease began. The hours of greatest activity corresponded to the hours of greatest light intensity, 80 per cent or more.

Similar photosynthetic behavior was noted in Taraxacum during the morning hours, the maximum being reached at 2 o'clock, after which a decrease occurred in the total photosynthetic activity. This supposedly indicates that translocation and respiration were taking place more rapidly than manufacture.

No definite correlation was found in the case of Helianthus between leaf position and photosynthesis. Inverted leaves showed a higher carbohydrate content than leaves in the normal position, although the twisting of the petiole might have been a factor. In the Taraxacum rosette, the leaves next the earth made less than half as much photosynthate as did the top leaves. In case of submerged leaves, decrease of photosynthate corresponded to depth of submergence for the first few centimeters below the surface.

In *Equisetum fluviatile*, *Helianthus annuus*, and *Phaseolus vulgaris*, relative transpiration and photosynthetic activity were approximately inversely proportional.

Blue light proved to be less active and red most active for photosynthate production. Rusts and mildews interfered with photosynthetic activity in all cases tested. *Puccinia coronata* in Avena reduced photosynthetic activity to 72 per cent when well developed but not erumpent, and to 48 per cent in the erumpent stage. A comparison of infected with noninfected regions showed the former to contain only 21 per cent as much photosynthate as the latter. *P. graminis* on Triticum reduced the photosynthate to 50 per cent in the stage before the pustules become brown, and to 39 per cent in the erumpent stage. For equal areas the infected region showed 8 per cent as much photosynthate as did other portions of the leaf.

Uromyces on Arisæma decreased photosynthate to 78 per cent when the sori were well developed but still white, and to 40 per cent when the spores became yellow and the sori were erumpent. Erysiphe covering half the surface of the leaf of Aquilegia reduced the photosynthetic activity to 95 per cent, and when covering the whole leaf to 65 per cent.

Animal parasites reduced the apparent activity of the leaf of the host, supposedly by abstracting food and, to a small extent, by reducing the quantity of light received.

Comparative transpiration of tobacco and mullein, J. D. SAYRE (*Ohio Jour. Sci., 19 (1919), No. 7, pp. 422–426, fig. 1*).—Comparative studies of the transpiration rates of tobacco and mullein were carried on during the winters of 1917 and 1918 in the Ohio State University botanical greenhouse and laboratory with special apparatus capable of making a continuous record as regards water loss for as many as six different plants simultaneously. In these studies, use was also made of instruments recording temperature, humidity, sunshine duration, evaporation, and wind velocity. From these records curves were obtained, which are here presented, details and discussion being reserved for another paper.

Comparisons are made between a thin-leaved tobacco plant (*Nicotiana* sp.) and mullein (*Verbascum thapsus*). It was found that mullein leaves offer greater resistance to water loss in darkness than in light, but less in wind than in still air, responding to changes in environment at least as much as do tobacco leaves. The removal of hairs from mullein leaves does not alter the resistance of the leaves to water loss in still air and light, though it slightly decreases the resistance to water loss in wind and light and greatly decreases its loss in still air and darkness. The conclusion is that hairs as protective covering against ordinary intensities of wind and light may be disregarded so far as mullein is concerned.

Rythm in the transpiration curve was noticed in certain cases, and experiments were performed investigating the conditions under which such rhythm appears. It appears that rhythm in transpiration is due to some definite internal condition, probably connected with stomatal activity.

Rate of growth of bamboos, B. B. OSMASTON (*Indian Forester, 44 (1918), No. 2, pp. 52–57, pl. 1*).—Careful measurements are recorded of the growth by

night and by day of young culms of bamboo (*Dendrocalamus giganteus*). The growth was at first very slow, gradually quickening for four to six weeks until the bamboo was some 12 ft. in height. The maximum rate of growth attained continued somewhat uniformly for several weeks, after which the rate gradually decreased until the end of November.

It appears that new bamboo culms commence to develop during the middle of the rainy season, and complete their height growth about two months after the rains. Growth during the night was nearly double that in the day. The aggregate of the height increments by day during 14 days was 3.7 ft. as against 5.95 ft. by night. This striking difference was not found to be directly connected with illumination or temperature.

The maximum rate of growth is attained during the time of greatest relative humidity. The most rapid growth reported for a single day was 13 in. on September 1. This growth was maintained approximately for at least nine days, the culm reaching its full height (71 ft.) at the end of three and one-half months, or about November 15.

Cotton tolerance to alkali in the field, C. N. CATLIN (*Arizona Sta. Rpt. 1919, pp. 408, 409*).—In continuation of previous reports on the tolerance of cotton to alkali (E. S. R., 43, p. 724), a statement is given of similar observations made in the Salt River Valley. The results in general show good cotton produced on soil containing 0.4 per cent soluble salts with a low content of chlorid, stunted and unprofitable cotton on soils containing 0.4 to 0.6 per cent soluble salts with 0.1 to 0.3 per cent chlorids, and total destruction of the crop on soils containing upward of 0.6 per cent soluble salts of which one-half or more was chlorids.

The injuriousness of some magnesium compounds for certain plants, H. COUPIN (*Rev. Gén. Bot., 32 (1920), Nos. 373, pp. 19–43; 374, pp. 78–90*).—The general conclusion from the experiments here recorded, involving different plants and magnesium compounds, is that the latter are, with the exception of phosphate, more or less injurious to vegetation. The susceptibility varies with the species, so that it may constitute a limiting factor in geographical distribution.

Laboratory experiments on the sprouting of potatoes in various gas mixtures, F. KIDD (*New Phytol., 18 (1919), No. 8, pp. 248–252*).—In the study here noted, potatoes were inclosed in glass desiccators of about 3,000 cc. capacity and the artificial gas mixtures made up by the method previously described (E. S. R., 31, p. 521).

From the tabulated results of the three series of experiments, carried out as described, it is concluded that oxygen is harmful to the potato tuber in concentrations above 5 to 10 per cent (the optimal concentration for sprouting), and at 80 per cent killing in four to five weeks. The injurious action of oxygen is increased in the presence of carbon dioxid. The latter gas used alone inhibits sprouting in a concentration of 20 per cent, which appears to be somewhat harmful, and higher concentrations cause marked injury and death.

Report on the proposed electrolytic treatment of seeds (Wolfryn process) before sowing, E. J. RUSSELL (*Jour. Min. Agr. [London], 26 (1920), No. 10, pp. 971–981*).—Attempts to settle the question as to the efficacy of treating seeds by electrolysis (Wolfryn process) in causing increased yields are said to show no unquestionably beneficial and reliable results.

An experiment on regulation in plants, E. N. HARVEY (*Amer. Nat., 54 (1920), No. 633, pp. 362–367, fig. 1*).—As bearing upon experimentation and conclusions reported by McCallum (E. S. R., 17, p. 956) and by Loeb (E. S. R., 42, p. 26), the author gives an account of experiments performed by himself.

In these, for the purpose of dividing a morphologically intact bean plant into two portions physiologically, a jet of steam was applied to the stem between the cotyledons and the first pair of leaves. It was found that in some cases the leaves and growing tip continued to grow with unchecked or even increased rapidity. The buds in the axils of the cotyledons started growth and roots appeared just above the upper margin of the steamed portion, which had shriveled into a hard woody connection about 2.4 cm. in length. The evidence is considered conclusive as against the existence of definite root inhibitive substances, and as opposed to the view of the existence of shoot inhibitive substance, though not unequivocal in the latter case. The possibility of electrical polarity becoming a factor is discussed.

Some orienting effects of monochromatic lights of equal intensities on Fucus spores and rhizoids, A. M. Hurd (*Natl. Acad. Sci. Proc., 5 (1919), No. 6, pp. 201–206*).—The purpose of the investigation here briefly detailed was to study the power of pure monochromatic lights to establish the polarity of the germinating spores of *F. inflatus*, and also to answer questions indicated concerning the negative phototropism of the young rhizoids. Regarding these, it is stated that white light too weak to orient the cleavage planes would cause the growing tips to turn sharply away from the source of light.

A characteristic orientation of cleavage planes perpendicular to the direction of the center of the group of cells numbering from two to ten is described. The only explanation suggested is that of a diffusion gradient of some substance emanating from a growing spore or of some substance used up by such spore. A continuation of this study is to be directed to a search for such a substance.

The optimum illumination for the development of Stichococcus bacillaris, M. Denis (*Rev. Gén. Bot., 32 (1920), No. 374, pp. 72–77*).—*S. bacillaris*, while attaining ordinary development in spring water, attains its complete development only in a nutritive medium. The intensity as regards the illumination producing the greatest dry weight corresponds to a low solar illumination. Degrees of illumination correspond to morphological reactions which are indicated.

The relative effect of phosphate-acetate and of phosphate-phthalate buffer mixtures upon the growth of Endothia parasitica on malt extract and corn meal media, M. R. Meacham, J. H. Hopfield, and S. F. Acree (*Jour. Bact., 5 (1920), No. 3, pp. 305–308*).—A study of *E. parasitica* on the media indicated shows that this organism grows well on such media when regulated at optimum values near pH=5.7, but better with the phosphate-phthalate buffer. The malt extract appears to give better growth than the corresponding corn meal medium containing the same buffers.

A method of determining the relative toxicity of sodium, potassium, lithium, and other ions toward Endothia parasitica: Data on sodium chlorid, M. R. Meacham, J. H. Hopfield, and S. F. Acree (*Jour. Bact., 5 (1920), No. 3, pp. 309–313, fig. 1*).—*E. parasitica* is said to grow well on malt extract, corn meal extract, and bean decoction media regulated between pH=5 and pH=7, and buffered with 0.02/N K_2HPO_4 and 0.02/N acetic acid. In such a buffered malt extract medium, regulated at about pH=5, the addition of NaCl up to 0.63/N, or 3.65 per cent, causes a gradual decrease in growth rate to about 25 per cent of normal value. This salt is therefore considered mildly toxic. The form of the growth curve suggests that the salt ions may be more toxic than the salt molecules.

On the retention of vitality by algæ from old stored soils, B. M. Bristol (*New Phytol., 18 (1919), No. 3–4, pp. 92–107, figs. 2*).—Cultural experiments

with old stored soils are said to have shown that certain algæ belonging to the Myxophyceæ, Bacillarieæ, and Chlorophyceæ possess extraordinary powers of retaining vitality during very long periods of rest, and that the length of such periods is determined in some cases at least by the degree of dryness of the soil during the resting period. The algæ described are said to differ in some respects from typical forms, but they are thought to be only cultural forms.

Phenomena of cell division in the cambium of arborescent gymnosperms and their cytological significance, I. W. BAILEY (*Natl. Acad. Sci. Proc., 5 (1919), No. 7, pp. 283–285, fig. 1*).—The author gives a brief preliminary account of some of the cytological phenomena encountered in a series of investigations upon the variations in size and structure of tracheary cells in vascular plants, notably of a certain type of cell division. In this type the process of cell plate formation is greatly extended, as regards both space and time, and so dissociated from the usual phenomena of karyokinesis as to be supposedly of significance in connection with the dynamics of cell division.

A preliminary study of the root nodules of Casuarina, M. J. NARASIMHAN (*Indian Forester, 44 (1918), No. 6, pp. 265–268, pls. 2*).—The root nodules of Casuarina, adapted to the sandy seacoast but successfully cultivated in India on many of the wild vaste lands, have been studied by the author, and are regarded by him as helpful rather than otherwise. It is concluded that sandy soils are improved by Casuarina as to the growth of the succession of the inland flora.

FIELD CROPS.

Collecting and recording breeding notes on field crops, W. HANSEN (*Ztschr. Pflanzenzücht., 6 (1918), No. 3–4, pp. 119–138, fig. 1; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 10 (1919), No. 5, pp. 539–543*).—This article presents a detailed description of the methods followed in the collection and recording of data on field crop breeding plats at the plant breeding station of Eckendorf, near Bielefeld, Germany. Numerous specimen observation and breeding forms specially arranged for recording various data on the cereal grasses, legumes, and fibers are included.

Do small or large crops show the more exact experimental results? R. K. KRISTENSEN (*Tidsskr. Planteavl, 27 (1920), No. 1, pp. 176–185*).—This article is a review of results secured in pot experiments with liquid manure and chemical fertilizers by F. Honcamp and E. Blanck.[1] The data show that the absolute standard deviation of the crop increases with the increase in yield, but that when the standard deviation is expressed in percentage of the crop it decreases with an increase in yield. It is pointed out that this relation conforms to the law of errors, and that crops varying in size behave in respect to accuracy as do samples varying in size selected as average samples from any given substance.

Report of [field crops] work at Rampart Station, C. C. GEORGESON and G. W. GASSER (*Alaska Stas. Rpt. 1919, pp. 9–12, 32–39, 42, 43, pls. 3*).—This describes work with field crops conducted in 1919 along the same general lines as that previously noted (E. S. R., 44, p. 329).

The season was characterized by a winter with subnormal snowfall and heavy windstorms, and a summer with abnormal rainfall and a frost-free period of 93 days. The precipitation for the year beginning October, 1918, was 1.32 in. above the average.

Variety testing and hybridization work have been continued with spring and winter wheat, rye, barley, and oats, and the results secured outlined. A hybrid spring wheat, 30a, a cross between Chogot and Marquis, is considered very

[1] Arb. Deut. Landw. Gesell., No. 282 (1916).

promising. Although possessing the bearded head of the female parent, it showed more vigor and had larger heads and stronger straw. Hybrid No. 62a from this cross resembled the male parent, but with more vigorous head and with spikelets containing one or two more grains. Oat hybrid, 51a (Hull-less 304×Norwegian 117), showed characteristics transmitted by both parents, was better than either in regard to size and vigor, and possessed the earliness of the male parent. Pamir barley excelled in point of earliness, maturing in 80 days. Hybrid 1a (Pamir×Champion, a late beardless variety) was very desirable, as was No. 19b (1a×Hull-less, a smooth, 4-rowed, medium early variety). Further trials of winter wheat were deemed useless on account of the long severe winters.

Continued success with *Medicago falcata* is noted, although little seed ripened on account of the comparatively low prevailing temperature. Although *Vicia cracca* produced forage and seed in splendid manner for several years, excelling *M. falcata*, later results have been inferior. Alaska garden and Irkutsk field peas showed superiority over other varieties. In limited tests of potato varieties, Early Six Weeks and Bliss Triumph produced the best yield.

Report of [field crops] work at Fairbanks Station, M. D. Snodgrass (*Alaska Stas. Rpt. 1919, pp. 44–52, pls. 2*).—Work with field crops conducted during 1919, in continuation of that already noted (E. S. R., 44, p. 327), is described. The season is described as the driest known to farmers of the interior, there having been but 1.53 in. precipitation during eight months, September 1, 1918, to April 30, 1919. The frost-free period extended over an interval of 115 days.

Work with cereals included variety and head-to-row tests and field trials of spring wheat, oats, and barley. Spring wheat grown on north and south slopes made acre yields of 17.3 and 27.8 bu., respectively. Romanow, with 30 bu. per acre, and Siberian No. 1, with 27 bu., required 120 and 110 days, respectively, to mature. Canadian oats made an average acre yield of 70 bu. on 9.5 acres, and on 7 acres of flat frozen land an average of 79.2 bu. per acre. Although Hansen oats made the highest yields in variety tests, the variety was deemed too late in maturity for successful grain production in the region. Oats following clover gave a yield of 44.8 bu. for the second year as compared with 27.6 bu. on grain land, repeating the results of the previous season. Wisconsin Pedigree, with 31.7 bu. in 111 days, gave the largest return in barley tests.

Although potatoes set well, lack of moisture depressed the size of tubers and resulted in a larger percentage of second-grade tubers and culls. Carrots, sugar beets, and Petrowski turnips made only fair yields.

Canadian field peas were grown for seed and for hog feed with fair success. The yield of ripe peas was low. Red clover made satisfactory growth in rotations and as a green manure crop, while alfalfa sown as green manure came in good stand but made slow growth. Semipalatinsk alfalfa continued to show hardiness and adaptation to the region.

Report of [field crops] work at Kodiak Station, W. T. White (*Alaska Stas. Rpt. 1919, pp. 55, 57–59*).—This reports work with field crops conducted in continuation of that previously noted (E. S. R., 44, p. 328). The season is described as being very unfavorable to crop production with a very late wet spring and a hot dry period in June.

Giant Russian sunflowers planted in beds attained a height of 2 ft. on south slopes, but did not offer much promise as a forage crop. Grimm alfalfa produced an 80 per cent stand of spindling yellow plants, reaching 8 in. in height. Spurry grew to 10 to 12 in. and showed a strong vining tendency, while Petrowski turnips, buckwheat, and vetch made but limited growth.

The addition of about 2 oz. of nitrate of soda to the hill of potatoes already fertilized with cow manure stimulated a much greater vine growth and a yield of twice the number of tubers produced on plats with manure alone or unfertilized.

Report of [field crops] work at Matanuska Station, F. E. RADER (*Alaska Stas. Rpt. 1919, pp. 67–75*).—This describes the continuation of work previously noted (E. S. R., 44, p. 328).

The winter of 1918–19 was very mild, being characterized by light snowfall and followed by a late spring. The frost-free period was 132 days, 9 days less than two previous seasons.

Winter rye varieties survived the winter in perfect condition, Brandon and Hogot being the best from appearances. In tests of oat varieties Finnish Black oats gave an estimated acre yield of 30 bu. Beardless and hull-less barley with 30 and 20 bu. to the acre, respectively, made fair crops. Siberian No. 1 and Romanow wheat produced good yields, while Marquis matured late or not at all. Buckwheat made 12 bu. per acre.

Sunflowers planted in a garden reached a height of 6 ft. and heads were beginning to form when the plants were killed by frost. Tests of grasses, clovers, and alfalfas are also noted. Although timothy survived the winter, it has proved unsatisfactory for hay or pasture everywhere in Alaska. Brome grass and Kentucky bluegrass survived, but the value of the grasses are yet to be determined. Canadian field peas are considered superior to any other annual legume, as seed can be grown.

White Bliss, Irish Cobbler, American Wonder, Rural New Yorker, and Early John led in edibility in tests of 40 potato varieties. Almost 11 tons of tubers per acre were produced on the land devoted to the variety test.

Golden Tankard mangels and Giant Feeding sugar beets gave acre yields of 8.5 and 8.3 tons, respectively, while other varieties gave much smaller yields. In another test, sugar beets made an estimated yield of approximately 5 tons per acre on the best parts of the plats. Results of analyses of sugar beet samples, reported by the Bureau of Plant Industry of this Department, showed a sucrose content ranging from 17 to 21.4 per cent with a coefficient of purity of juice from 78.9 to 83.3. This is considered satisfactory from a sugar-making standpoint. Beets set out for the purpose of seed production grew tops 5 ft. high and set much seed, none of which ripened.

[Report of field crops work in Arizona], G. E. THOMPSON and R. S. HAWKINS (*Arizona Sta. Rpt. 1919, pp. 415–420, figs. 2*).—The continuation of work along the same general lines as previously indicated (E. S. R., 43, p. 733) is described.

Dwarf milo made satisfactory grain yields at the Prescott dry farm, but no grain yields of importance were secured from other crops. Papago sweet corn was the best silage crop, averaging 25 tons per acre on the best land. On account of the high elevation the climate is considered better adapted to corn than to sorghums. Sudan grass continued to show promise in the region.

Red Amber sorghum proved the most satisfactory crop under strictly dry farm conditions at Sulphur Spring Valley dry farm. Dynamiting the subsoil did not influence the yield of sorghum in 1919. Sudan grass, soy beans, cowpeas, and velvet beans all proved failures because of drought.

In tests of legumes on five farms, Red Ripper cowpeas were found most desirable. Soy beans were not satisfactory, as in previous years, practically every variety producing a shriveled and unmarketable bean. This was thought due to the dry atmosphere, as the beans shriveled regardless of the moisture supply in the ground.

Mexican June corn proved best in the Salt River Valley, while the large eastern varieties were unable to withstand the hot dry atmosphere of the valleys. Milo and hegari produced acre yields in excess of 4,000 lbs. of thrashed grain. Orange sorghum was best from a silage standpoint.

Results of fertilizer, spacing, and date of planting tests with Egyptian cotton were largely inconclusive.

Early Baart wheat proved the best of the varieties tested for average conditions in the Salt River Valley. Kanred did not equal either Early Baart or local Turkey wheat. Although durum wheats yielded well, difficulty in marketing limits their usefulness. Common 6-row barley, Abruzzi rye, and Texas Red rust-proof oats demonstrated their superiority over other varieties.

[Report of plant breeding work in Arizona], G. F. Freeman, W. E. Bryan, and E. H. Pressley (*Arizona Sta. Rpt. 1919, pp. 456–462*).—Observations on selections of pedigreed races of alfalfa and comparative tests of bean varieties and hybrid and pure wheat strains are reported in continuation of similar work previously noted (E. S. R., 43, p. 734).

Hybrid No. 650, the result of crosses between Sonora and Algerian Macaroni wheats made in 1913, produced 3,515 lbs. per acre as compared with 2,921 lbs. from Early Baart. Results of milling and baking tests of the wheats studied are given in tabular form.

Of 4,910 F_2 plants grown from a Turkey-Sonora cross, 66 were as early as Sonora, and of these 66, 12 had grains all as hard as the Turkey parent. A marked positive correlation seemed to exist between fertility, as indicated by the number of grains per spikelet, and earliness. In data secured on 366 F_2 plants a correlation of 0.5846 ± 0.0232 was found between the ratio of grains to spikelets and date of first head.

[Report of work with field crops at the Langdon [N. Dak.] Substation, 1914 to 1919], P. F. Trowbridge (*North Dakota Sta. Bul. 134 (1920), pp. 8–11, 24–31, figs. 2*).—These pages report data collected by E. D. Stewart in connection with crop rotation trials with corn, wheat, oats, barley, millet, flax, potatoes, timothy, and clover; variety tests with corn, wheat, rye, potatoes, oats, and barley; seeding experiments with wheat, oats, barley, and potatoes; and field trials of sunflowers, alfalfa, sweet clover, red clover, field peas, slender wheat grass, brome grass, timothy, millet, feterita, kaoliang, and Sudan grass conducted during the period 1914 to 1919, inclusive. Previous work along the same general lines has been noted heretofore (E. S. R., 32, p. 530).

In 3-year rotations wheat following fallow produced an average of 1.09 bu. more than when following corn during the period embraced by this report, but the cost of maintaining a good fallow nearly equaled the cost of caring for the corn. Oats following wheat after fallow averaged 4.48 bu. per acre better than when following wheat after corn. Wheat grown continuously averaged 11.05 bu. per acre during the period. In studies of the best position of flax in a rotation, the highest 6-year average, 9.24 bu., was made in a 4-year rotation of wheat, flax, wheat, and potatoes.

Kubanka, an amber durum wheat, with an 11-year average of 26.7 bu., outyielded Fife and Bluestem by 9 bu. per acre, and its average yield during the period 1913 to 1919 exceeded that of Marquis by 7 bu.

The use of willows for windbreaks was found to decrease winterkilling of alfalfa and red clover, and to affect the yield for 150 ft. by storing snow water.

Work with field crops in South Carolina, C. P. Blackwell, W. J. Young, and R. E. Currin (*South Carolina Sta. Rpt. 1920, pp. 27–29, 45, 46, 61, 62*).—Variety, fertilizer, and breeding tests with various field crops are briefly noted. Results of variety tests show Cleveland to be the best short staple cotton for

wilt-free land, Dixie Triumph best for infected land, and Webber No. 49 and Webber No. 82 best long-staple vareities. Fulghum and Appler oats, Boggs Bluestem, and Leap Prolific wheat, and Douthit and Lowman corn led in tests of grain varieties.

Sweet potato fertilizer tests conducted in cooperation with other States indicated that potash was not necessary on the Piedmont soils. The use of large amounts of nitrogen produced luxuriant foliage and stringy roots with increased size of sweet potato rather than increased yield. Where the sweet potatoes graded according to size and form were bedded for production of sets, with equal weights, a larger number of plants were secured from the smaller sets.

Sixteen years of dry-farm experiments in Utah, F. S. Harris, A. F. Bracken, and I. J. Jensen (*Utah Sta. Bul. 175 (1920), pp. 3–43, figs. 3*).—Results of variety tests, cultural trials, and rotations with winter and spring cereals, peas, corn, and potatoes, field tests of forage crops, and a study of cropping systems with winter wheat conducted for various periods from 1904 to 1919 at the Nephi Substation and eight county experimental dry farms in the State are summarized in this publication. The soils and climatic conditions in the region are briefly described. Most of the work was in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture.

Alfalfa ranked highest in the dry-farm forage crops at Nephi, with a 15-year average acre yield of 1,980 lbs. Sweet clover, tall meadow oat-grass, and brome grass gave fair yields, but were considered more or less objectionable.

In tests of winter wheat between 1904 and 1919 Beloglina led with an average yield of 26.7 bu. per acre and was followed by Crimean and Turkey. The best spring wheat varieties included Chul, Saumur, and Early Baart, and Kubanka and Adjini of the durum group. Winter wheat is recommended instead of spring wheat wherever possible. Bulgarian and Turkestan, with 33.6 and 33.2 bu., respectively, were first among winter barleys. Spring barley is not advised except in cases of winterkilling of winter varieties. Although the average acre yields of the best varieties of both spring and winter oats exceeded 20 bu., the crop did not compare favorably with barley.

Corn, peas, beans, and potatoes did not give good results except in seasons of high spring rainfall, the amount of precipitation before seeding time determining in large degree the success of these crops during a given season. Except when replacing fallow, the annual culture of these crops in rotation with wheat has not given a profit.

In comparisons of cropping systems for winter wheat the largest net returns were produced by land cropped two years with one fallow, the first crop grown after fall plowed fallow and the second after double disking. Although more expensive, alternate cropping had certain advantages, often making it more desirable.

At Nephi spring plowing immediately followed by harrowing, with one weeding and another harrowing just before fall seeding, proved to be the most economical method of preparing the seed bed for fall seeding under the alternate system of cropping. Disking dry-farm land in the fall immediately after harvesting was not profitable. Results of depth of plowing tests show the proper depth to be between 5 and 10 in. Spring cultivation of winter wheat failed to produce an increase and was done at a loss. Rate of seeding tests indicated that winter wheat yielded best when sown at the rate of about 6 pk. to the acre.

Rainfall, evaporation, and frost data are included.

[The Woburn field experiments, 1919], J. A. Voelcker (*Jour. Roy. Agr. Soc. England, 80 (1919), pp. 418–425, 428, 429; also in Woburn Expt. Sta. Rpt.*

1919, pp. 3–10, 13, 14).—The continuation of work along the same general lines as previously noted (E. S. R., 41, p. 825) is described. The season of 1918–19 was not considered favorable agriculturally.

The maximum yield in the continuous wheat experiments, 22 bu. of grain and 2,264 lbs. of straw, was secured from the plat receiving farmyard manure. The plat receiving mineral manures and in alternate years nitrate of soda equivalent to 50 lbs. of ammonia was next, with 16.3 bu. of grain and 1,689 lbs. of straw. The average yield of the untreated checks amounted to 7.45 bu. of grain and 1,628 lbs. of straw. Mineral manures alone produced 9.7 bu. of grain and 1,108 lbs. of straw. Nitrate of soda showed superiority over sulphate of ammonia, and the addition of minerals to the latter did but little good as compared with the addition of lime. Double dressings of nitrate of soda alone gave no better results than single dressings. Rape dust, with 11.2 lbs. of grain and 1,232 lbs. of straw, gave but half the return of farmyard manure. Phosphates without potash produced 13.7 lbs. of grain and 1,374 lbs. of straw, while potash without phosphates produced 12.1 lbs. of grain and 1,201 lbs. of straw.

Farmyard manure produced the largest crop, 28.3 bu. of grain and 1,802 lbs. of straw, in the continuous barley experiments and was followed by the plat receiving nitrate of soda with sulphate of potash, with 26.5 bu. of grain and 1,635 lbs. of straw. The use of sulphate of potash gave 8 bu. more per acre than nitrate of soda with superphosphate. The untreated checks yielded an average of 11.8 bu. of grain and 812 lbs. of straw per acre. Mineral manures alone gave increases of 2.2 bu. per acre without lime and 6.1 bu. where lime had been used in 1915. Sulphate of ammonia alone or with minerals only gave small returns, but the addition of lime produced a crop in all cases. Double dressings of sulphate of ammonia with the same amount of lime and minerals gave a lower yield than a single dressing. Nitrate of soda alone yielded less than the untreated checks, but combined with mineral manures it produced an increase of 8 bu. Doubling the amount of nitrate of soda used with minerals gave an increase of 12 bu. per acre. Rape dust failed to be of benefit.

Tests of the comparative effect on barley yields of the unexhausted residues from cake and corn feeding on rotation plats showed the cake-fed plat to yield 18.2 bu. of grain and 1,360 lbs. of straw and the corn-fed plat 17.4 bu. of grain and 1,358 bu. of straw. But little material difference between the plats was noticed in the hay yields of red clover sown with barley in this series.

The best results in the improvement of old pastures were secured from the plat that had received an application of 12 tons of manure in 1913, with a yield of 3,528 lbs. of hay as compared with 2,436 lbs. from the untreated check. In comparative tests of different kinds of lime for grassland, the highest yield, 3,136 lbs. of hay, was secured from Lias lime applied in 2-ton lots in 1910 and in 1916. The untreated check yielded 2,744 lbs. of hay. Ground chalk gave the best results in a comparison of different forms of lime, producing 3,752 lbs. of hay as compared with 3,136 lbs. from the untreated plats.

[Work with field crops in Uruguay], A. Boerger (*El Instituto Fitotécnico y Semillero Nacional "La Estanzuela." Montevideo: Min. Indus., 1920, pp. 27, figs. 8*).—This describes the work of the National Institute of Phytotechnology and Seed Station of La Estanzuela, the so-called "Svalöf of South America," including distribution of seed, variety, and cultural tests, and breeding work with wheat, oats, barley, corn, flax, legumes, and miscellaneous forage crops.

Notes on the principal native and cultivated forage plants [of Brazil], E. C. de Sousa Brito (*Apontamentos Sobre as Nossas Principaes Forragens Nativas e Cultivadas. Rio de Janeiro: Min. Agr., Indus. e Com., Serv. Inform., 1918, pp. 45, pls. 15*).—This publication describes and illustrates the more im-

portant native and exotic grasses, legumes, and miscellaneous plants used for forage in Brazil, and indicates their distribution, adaptation, and feeding value.

[Report of field crops work in Mesopotamia, 1919], R. J. D. GRAHAM, C. S. CAMERON, R. THOMAS, and C. R. WIMSHURST (*[Mesopotamia] Agr. Dir. Admin. Rpt., 1919, pp. 3–5, 8, 9, 10, 12, 13, 14, 15, 17–19, 20, 21–24, 25, 26, 27, 29–33, 36, 37, 38*).—This report describes rather limited variety tests of cotton, corn, wheat, and peanuts; cultural tests and breeding work with cotton; and field trials of barley, oats, juar, rice, gram, sugar cane, potatoes, berseem, and sunn hemp.

Principal fodders in the Central Provinces and Berar, including the small bamboo (Dendrocalamus strictus), D. CLOUSTON and F. J. PLYMEN (*Agr. Jour. India, 15 (1920), No. 4, pp. 380–385, pl. 1*).—The authors present comparative analyses of the native grasses and legumes of the region, and note that of many fodder plants tested, berseem clover (*Trifolium alexandrinum*) and the small bamboo (*D. strictus*) alone have shown sufficient promise to warrant their extensive culture. Cultural methods and uses of the two crops are briefly indicated.

Moisture as a factor in grain handling and grading, H. M. STEECE (*Dakota Farmer, 40 (1920), No. 11, pp. 1144, 1145*).—This article discusses the factors influencing the moisture content of grain, the importance of the moisture test in the determination of grades, the use of driers in controlling moisture content, and the influence of moisture content in export grain. Precautions to be observed by the farmer, country grain dealer, and exporter in handling and loading grain are outlined in brief.

Handling soft corn, H. D. HUGHES (*Iowa Agr., 21 (1920), No. 7, pp. 269–271, 292, 294, figs. 2*).—Heated air blown through the center of a crib of soft corn, in experiments conducted by the Iowa Experiment Station, is said to have reduced the moisture content of the corn from over 30 per cent to less than 10 per cent in 24 hours at an approximate cost of 3 cts. per bushel for fuel and power. The outdoor temperature at the time of this trial ranged between 35 and 45° F. In a similar test with an average outside temperature of 8° the moisture content of a second crib of corn was reduced from 30 to 13 per cent at an average fuel and power cost of 2 cts. per bushel. These and subsequent tests indicated to the author that soft corn can be dried and rendered safe for storage on the farm where grown at a relatively low cost. The method of drying and necessary equipment are briefly described.

The history of kidney cotton, F. L. LEWTON (*Jour. Wash. Acad. Sci., 10 (1920), No. 21, pp. 591–597, figs. 2*).—A résumé of the accounts of early explorers regarding kidney cotton (*Gossypium lapideum* Tussac) and studies of the species made by botanists during the eighteenth and nineteenth centuries.

The production of binder-twine fiber in the Philippine Islands, H. T. EDWARDS (*U. S. Dept. Agr. Bul. 930 (1920), pp. 19, figs. 4*).—This publication discusses the Philippine Islands as a source of binder-twine fiber, describes the present condition of the maguey industry in the islands, and outlines the purposes and results of the cooperative work conducted by the Philippine Bureau of Agriculture and this Department.

The dependence of the grain-producing industry on binder twine manufactured from henequen and sisal, more than 90 per cent of which is received from Yucatan, is pointed out as a grave menace to American agriculture. An increased supply of binder-twine fiber produced within the territory of the Unied States or in American possessions is considered essential to remedy this situation. The Philippine Islands possess the requirements necessary for the development of a flourishing sisal industry, but the production of binder-

twine fiber has been restricted in the past by the general use of antiquated methods, and a number of reforms in this industry are urgently needed.

As a result of the three years' cooperative work conducted for the purpose of encouraging the increased production of binder-twine fiber in the islands, machine cleaning has been established on a commercial basis, 12 large modern fiber-cleaning machines having been purchased by Philippine planters; 500,000 sisal bulbils have been imported into the Philippine Islands from the Hawaiian Islands; and there is now enough sisal in the Philippines to furnish an abundant supply of plants for future use. While there has been no marked and widespread improvement of conditions on the plantations, a fair degree of progress is said to exist.

The production of maguey and sisal fibers in the Philippine Islands for the first five months of 1920 has been larger than during any similar period in previous years, amounting to approximately 20 per cent of the henequen production of Yucatan.

Flax culture and preparation, F. Bradbury (*London: Sir Isaac Pitman & Sons, Ltd., [1919], pp. XII+154, pls. 17, figs. 76; rev. in Bul. Imp. Inst. [London], 18 (1920), No. 1, p. 144*).—An account of flax culture and preparation is presented in this book, which deals with the various processes involved from the selection of seed to the marketing of scutched fiber, with special reference to conditions in the British Isles. The author discusses soil and climatic adaptations and the practices employed in growing and harvesting the crop, and describes and illustrates the processes of rippling or deseeding, retting, breaking, and scutching.

Flax culture [in Argentina], J. F. Baldassarre (*Rev. de Revistas [Buenos Aires], 3 (1920), Nos. 27, pp. 12, 13, figs. 2; 28, pp. 12–14, figs. 3; 29, pp. 12-16, figs. 3*).—The importance of the flax industry in Argentina is briefly discussed, and methods of cultivation and harvesting practices followed in the Republic are described, together with notes on crop pests and diseases.

Flax and hemp: Culture and uses, A. Ribeiro de Castro Sobrinho (*Linho e Canhamo, Cultura e Applicações Industriaes. Rio de Janeiro: Min. Agr., Indus. e Com., Deleg. Exec. Prod. Nac., 1919, pp. 24, figs. 15*).—The crops are briefly described and their adaptations, cultivation, preparation, and uses noted.

Hemp: Its culture and products, R. de Sanabria (*Hacienda, 15 (1920), No. 12, pp. 354–362, figs. 14*).—This presents a description of hemp (*Cannabis sativa*, also *C. indica*) and of its production, together with a discussion of the industrial exploitation of the crop and its products.

The classification and description of the jowars of the Bombay Karnatak, G. L. Kottur (*Bombay Dept. Agr. Bul. 92 (1919), pp. 16, pls. 7*).—A scheme of classification of the varieties of jowar grown in the Bombay Karnatak, based on the characters of the head, grain, and glumes, is presented, together with descriptions and illustrations of representative groups and notes on the local distribution of important varieties.

[Work with potatoes at the Sitka Station], C. H. Benson (*Alaska Stas. Rpt. 1919, pp. 23, 24*).—Work with seedlings and varieties was continued along the same lines as noted heretofore (E. S. R., 44, p. 330). The lack of warmth and sunshine is said to have resulted in yields much lighter than in previous years. Seedling No. 753 with an average of 432 bu. per acre made the highest yield recorded, while named varieties gave returns ranging from 100 to 370 bu. per acre.

[Report of work with potatoes in Arizona], F. J. Crider and A. F. Kinnison (*Arizona Sta. Rpt. 1919, pp. 442–444*).—Irish potatoes planted at 2-week intervals throughout the year at Yuma made the highest yields when planted in

the middle of January and next best production when seeded February 1. Plantings made during the latter part of the summer were rendered failures by high soil temperatures. The same variety planted at Tucson gave fair returns, August 1 plantings yielding at the rate of 4,704 lbs. of tubers per acre. Early Six Weeks with an acre yield of 16,611 lbs. led the variety tests at Yuma.

Spreading potatoes out thinly on the ground under an open shed resulted in a loss of but 5 per cent, and gave the best results in tests of methods of storing the spring crop through the summer.

Sweet potatoes graded to a uniform size and stored in an adobe house at temperatures of 85 to 90° F. during the first two weeks of storage and 55 to 60° F. during the remainder of the storage period developed no spoilage whatever, while those not graded and stored under like conditions in another adobe house sustained a rather large percentage of spoilage.

Fertilizers for potatoes, W. L. Slate, jr., and B. A. Brown (*Connecticut Storrs Sta. Bul. 106 (1920), pp. 39–48*).—Experiments to determine the need of potash by potatoes; the most profitable amounts of potash, nitrogen, and phosphoric acid to apply; and the best methods of applying the fertilizer are described. These tests were conducted from 1915 to 1918, inclusive, on Gloucester fine sandy loam, the most common soil type in eastern Connecticut.

From the results obtained in the trials, the authors consider that the use of potash up to 80 lbs. per acre was decidedly profitable on the particular soil involved, and consistently increased the percentage of marketable tubers. Tests on rather restricted areas led to the conclusion that on worn-out fields the use of nitrogen equivalent to ammonia up to 100 lbs. per acre was profitable. Definite conclusions were not obtained regarding the most profitable amount of phosphoric acid. Comparisons of the value of the fertilizer sown in one and two applications showed a small difference in favor of the single application.

Rice growing in California, C. E. Chambliss (*U. S. Dept. Agr., Farmers' Bul. 1141 (1920), pp. 22, figs. 10*).—This is a revision of Farmers' Bulletin 688, noted previously (E. S. R., 33, p. 834).

The short-grain rices, Wataribune, Butte (C. I. No. 1564), and Colusa (C. I. No. 1600) are considered best adapted to the great central valley of California. The long-grain and medium-grain varieties, represented by Honduras and Blue Rose, respectively, do not develop normally in California, as they mature later than the short-grain rices and produce comparatively low yields of grain of poor milling quality. Barnyard grass, the worst weed in the California rice fields, may be controlled and eradicated by summer fallowing and frequent cultivations of badly infested land prior to seeding to rice.

Observations on the culture of sugar beets, compiled by A. F. Kiehl (*Einige Beobachtungen beim Anbau von Zuckerrüben. Leipzig: Otto Hillmann, 1914, 4. ed., pp. 459, figs. 78*).—This is the fourth edition of a compilation of data secured in studies of sugar beet culture on farms at Reindörfel, Bernsdorf, Viehhöfe, and Hertwigswalde, all near Münsterberg, Silesia. The data on the annual crops from 1886 to 1901 on each field at the several centers are tabulated and fully discussed in this volume, and include detailed notes on soil conditions, topography, rotations, fertilizers, cultural methods, harvesting practices, crop yields, meteorological data, analyses, polarization studies, and plant disease infection. The experimental work conducted with sugar beets included variety, fertilizer, and cultural tests, together with studies of selections.

Obtaining cane from seed produced in Argentina, G. L. Fawcett (*Rev. Indus. y Agr. Tucumán, 10 (1919), No. 2, pp. 31–41, figs. 12*).—The flowering habits of sugar cane varieties, including La Criolla, Java 234, Kavangire, and P. O. J. selections Nos. 36, 100, 105, 213, 228, and 234, are described and illus-

trated, and the production of seedlings from seed grown in Argentina is discussed.

Sugar cane culture on the coast of Peru, N. Sohet (*Ann. Gembloux, 25 (1919), Nos. 7, pp. 265–279, figs. 3; 8, pp. 325–337*).—An account of the cultural methods and field practices employed in the production of sugar cane on the coast region of Peru, together with notes on environmental conditions and varieties.

Sugar cane and cane sugar production in Peru, 1918, J. Silva Santisteban (*Min. Fomento [Peru], Dir. Agr. y Ganadería, Estadis. Prod. Caña Azúcar, 1918, pp. 25, pls. 2*).—Considerable statistical information is given relative to the acreage and yields of sugar cane in the several departments of the Republic, together with data on the production, consumption, and trade in sugar, alcohol, and other products of the sugar cane.

Sunflower experiments, G. W. Putnam (*Michigan Sta. Quart. Bul., 3 (1920), No. 2, pp. 49–52, figs. 2*).—Sunflowers seeded May 26 at the Upper Peninsula Substation, Chatham, Mich., gave higher yields and better quality of silage material than seedings one and two weeks later. In tests of proper row distance and rate of planting, the rows at distances of 24 to 36 in. gave the best quality of silage, rows under 24 in. gave small stalks with a tendency to lose their leaves at a premature stage, while 42 in. rows tended to produce heavy stalks, reducing the quality of the silage. The 30 to 42 in. rows gave the heaviest yields and also required less seed per acre for a stand than did the closer plantings. Rows from 30 to 36 in. apart seeded at from 6 to 8 lbs. per acre are advised for the best results in northern Michigan.

Management of tobacco nurseries, H. Jensen (*Proefsta. Vorstenland. Tabak [Dutch East Indies], Meded. 33 (1918), pp. 39–55, pl. 1*).—Methods of fertilizing, watering, and exposing to sunlight considered best for obtaining strong, healthy plants are presented.

Field experiments with wheat at the Chapman and Merredin Experimental Farms [Western Australia], 1912–1919, G. L. Sutton (*West. Aust. Dept. Agr. Bul. 63 (1920), pp. 58, figs. 21*).—This reports experiments with wheat, including depth-of-plowing, rate-of-seeding, cultural, variety, and fertilizer tests and rotations, conducted at the Chapman and Merredin Experimental Farms from 1912 to 1919.

Top-dressing wheat, M. M. McCool, G. M. Grantham, and C. W. Simpson (*Michigan Sta. Quart. Bul., 3 (1920), No. 2, pp. 59, 60*).—Cooperative experiments in top-dressing wheat with commercial nitrogen on heavy and light soils in various parts of Michigan are described. Nitrate of soda at rate of 60 lbs. per acre and ammonium sulphate at rate of 43.8 lbs. were applied on different parts of the same fields during the last week of April.

On heavy soils an average increase of 0.78 bu. was secured from the use of the carriers, but at a net loss of $1.14 per acre. Applied on light soils the nitrogen produced an average increase of 5.34 bu., or a net gain of $7.34 per acre. Commercial nitrogen was found profitable on most of the light soils, but not generally on the heavy grades of soils. In most trials on acid soils, nitrate of soda was decidedly superior to sulphate of ammonia.

Wheat culture [in Brazil], A. Gomes Carmo (*A Cultura do Trigo. Rio de Janeiro: Min. Agr., Indus. e Com., Serv. Inform., 1918, pp. 68, figs. 40*).—This embraces a discussion of the field practices and cultural methods employed in growing wheat in Brazil, together with brief descriptions of the important varieties and notes on the producing regions, milling processes, and analyses.

Wheat production in Peru, 1918, J. Silva Santisteban (*Bol. Min. Fomento [Peru], Feb., 1920, pp. 119; also in Min. Fomento [Peru], Dir. Agr. y*

Ganadería, Estadis. Prod. Trigo, 1918, pp. 119).—Tabulated statistics are presented showing the acreage, seeding and harvest dates, yields, and consumption of wheat in the several departments and Provinces of Peru, and the annual import and export trade in wheat from 1910 to 1918, inclusive.

The impurities of wheat, G. Savini (*Staz. Sper. Agr. Ital., 52* (*1919*), *No. 7–9, pp. 361–374*).—The author discusses the significance of the impurities found in wheat and their effect on the commercial value, healthfulness, and palatability of flour. Tables are appended showing the percentage of various species of weed seed found in samples of hard and soft wheat obtained from Italian, European, Asiatic, American, African, and Australian sources.

[Proceedings of the American Seed Trade Association] (*Amer. Seed Trade Assoc. Proc., 37* (*1919*), *pp. 120, pl. 1; 38* (*1920*), *pp. 159, pl. 1*).—The thirty-seventh annual meeting held in Chicago, June, 1919, and the thirty-eighth annual meeting held in Milwaukee, June, 1920, are reported. In addition to routine business and committee reports, the work of the State and Canadian experiment stations in seed improvement and inspection is outlined.

Report of Canadian Seed Growers' Association, 1918–1920 (*Canad. Seed Growers' Assoc. Rpt., 15–16* (*1918–1920*), *pp. 44, figs. 2*).—This reports the annual meeting held at Ottawa in March, 1920, and outlines the activities of the association during the period of March, 1918, to March, 1920. Reports of annual meetings held during the period embraced by the report by members resident in Quebec, Ontario, Manitoba, and Prince Edward Island are also included.

Dodder, A. A. Hansen (*U. S. Dept. Agr., Farmers' Bul. 1161* (*1921*), *pp. 21, figs. 10*).—The weed and its manner of dissemination are described, important species indicated, and control and eradication methods suggested. The complete life cycle of dodder on legume plants is illustrated diagrammatically. The several species of dodder causing the most damage are small-seeded alfalfa dodder (*Cuscuta planiflora*), large-seeded alfalfa dodder (*C. indecora*), field dodder (*C. arvensis*), clover dodder (*C. epithymum*), common dodder (*C. gronovii*), and Chilean dodder (*C. racemosa chileana*).

Where the weed occurs in clover or alfalfa in small scattered areas, mowing and removal before dodder matures seed or else burning in the field is advised. If the infestation is so great that patch treatment is impracticable, the crop should be either plowed under or used for hay, and the aftermath grazed to prevent seed formation. If seed has formed, however, and the crop has been damaged seriously, the safest method is to cut the crop, allow it to dry, and burn it in the field.

HORTICULTURE.

[Horticultural investigations in Alaska], C. H. Benson, G. W. Gasser, W. T. White, and F. E. Rader (*Alaska Stas. Rpt. 1918, pp. 20–23, 24–29, 39–42, 43, 44, 59, 60, 75–77, 78–80, pl. 1*).—This is the usual progress report on varietal and cultural experiments with fruits, vegetables, and ornamentals at the Sitka Station and at the branch stations, with extracts from letters of settlers and others regarding results obtained from the seed and plant distribution and other plantings (E. S. R., 44, p. 336).

Breeding work with strawberries was continued. A number of hybrids showed normal growth, perfect blossoms, productivity, large berries which were of good color and excellent flavor, and peduncles strong enough to support the berries and keep them off the ground. These plants have proved hardy for two seasons.

The apple trees made satisfactory growth and blossomed freely. Yellow Transparent, Livland Raspberry, Keswick (Keswick Codlin), and Siberian crab were the only trees which developed fruit of any size. Most of this fruit was irregular in shape and none reached normal size.

The shortage of many kinds of vegetable seed led to tests at the Rampart Station with several kinds of vegetables. Progress is reported in ripening Early Jersey Wakefield cabbage, parsley, several varieties of peas, Pe-tsai, spinach, turnip, parsnip, and radish. Tests in growing Pe-tsai indicated that young beet tops and Swiss chard are superior for cooked greens, and that lettuce is to be preferred for salads. Mandan, a new variety of squash, gave promise of good results in warmer seasons.

At the Kodiak Station a decided increase in the amount of fruit set was noted with gooseberry and currant bushes receiving 0.5 lb. of nitrate of soda per bush.

At the Matanuska Station, apple trees set out in 1918 survived with only a fair degree of success, the Yellow Transparent being least affected. Strawberry plants survived the winter in perfect condition without artificial protection.

[Horticultural work at the Arizona Station], F. J. Crider and A. F. Kinnison (*Arizona Sta. Rpt. 1919, pp. 439–441, 444–446*).—This continues work previously noted (E. S. R., 43, p. 740).

In the date investigations the rainy season of 1918 showed a great variation in the adaptability of different varieties to moist conditions. At the Tempe orchard the Rhars variety was almost a total failure due to souring, which was brought about by the wet weather. The Deglet Noor was very badly affected by fungus spots at the Tempe orchard, but at the Yuma orchard, where the rain was less, a reasonably good quality date was produced. It is considered, however, that even in the Yuma Valley there is too much moisture present to produce ideal dates of this variety. The Hayany maintained its established record for withstanding adverse weather conditions; also Bentkabala, Nesheem, Nazl al Bacha, Tennessim, and Tadala suffered very little damage. The average yields per tree were 55 lbs. of fruit at Tempe and 62 lbs. at Yuma. A rather large percentage of rooted palms used in filling vacancies at Tempe started into growth. As the soil is extremely alkaline, the precaution was taken of using about a cubic yard of sweet soil at planting and a heavy straw mulch.

In tests with orchard cover crops on the Yuma Mesa, cowpeas proved the most satisfactory, making a larger growth and withstanding drought to a greater degree. As ground cover during summer, peanuts ranked next to cowpeas. Velvet beans made very little growth during summer, but grew rapidly in early fall, climbing on the trees to the extent of precluding their use as an orchard cover crop.

Of the newer fruits under test, the sapote, feijoa, and jujube made a satisfactory growth, withstanding a temperature of 20° F. at Tucson. Avocado trees were badly affected by the hot, dry weather.

Variety tests with tomatoes and spinach, and comparisons with spinach of various planting dates and methods of planting, are reported in tabular form.

[Report on horticultural investigations], W. J. Young (*South Carolina Sta. Rpt. 1920, pp. 46–49*).—A progress report on various lines of work conducted during the year.

In some pruning experiments with grapes conducted when the vines were active, it was found that hot water glass (sodium silicate), when applied to the freshly cut surface, effectually prevented the loss of sap by bleeding. In

work with bunch grapes a number of crosses were made, principally of Brighton and Lindley with several other varieties, and a good set of fruit obtained.

Breeding work has been started with blackberries and raspberries with the view of securing improved varieties adapted to South Carolina conditions. About 150 pure seedlings of the Haymaker raspberry have been grown, and several of these have borne fruit of sufficient promise to be propagated for further tests.

In some spraying experiments, Burgundy mixture, used for spraying plums, controlled brown rot with entire success. No defoliation of the trees or burning of the leaves was observed and the rot was controlled much better than in former years when self-boiled lime-sulphur was used. Further experiments in frost prevention have shown that spraying the trees with whitewash and other mixtures has no effect in delaying the opening of the buds. The method of pruning was found to have considerable effect upon the production of a crop following frosts in the blooming season. Peach trees, the tops of which were left rather dense, produced a satisfactory crop of fruit, while severely pruned trees gave little or no fruit.

Report of the Horticultural Experiment Station, 1919 (*Vineland, Ont. Hort. Expt. Sta. Rpt., 1919, pp. 60, figs. 21*).—A progress report on breeding and cultural experiments with fruits and vegetables, and on experiments with fruit and vegetable by-products (E. S. R., 42, p. 137).

Practically all of the peach hybrids and seedlings of 1913 breeding fruited in 1919. Descriptions and notes are given for those deemed worthy of further trial. New breeding work with peaches, raspberries, and blackberries is also recorded. Tabulated descriptions are given of the final selections from the 1913 strawberry breeding work. Breeding work with cucumbers has resulted in several desirable types of greenhouse cucumbers that are apparently capable of setting fruit without fertilization. Work was started in 1919 to secure vigorous inbred strains of several varieties of sweet corn.

For several years a test has been made of summer *v.* winter pruning as also compared with no pruning for apples. Summarizing the results to date, it is concluded that the lighter the pruning the greater the growth, the earlier the tree comes into bearing, and the heavier the yield during the early part of the tree's life at least. The lightly summer pruned trees, however, were very little, if any, behind the unpruned trees, especially when the increased cost of spraying and picking, increasing lack of color, and the general undesirable condition of the unpruned trees for future crops are considered. Light annual pruning just sufficient to retain the proper shape of the tree, to allow sunlight and air to get through, and to keep out all crossed and broken branches seems, therefore, to be the proper method to pursue for the young orchard until it comes into bearing. After the bearing age, pruning will probably have to be more severe to maintain a proper supply of new wood each year.

Detailed plans are given of new experiments on the study of the interrelation of pruning, soil fertility, and distance of planting in the peach; and a study of the effect of varying degrees of dormant pruning on the development of the apple. Tabular data are given showing the date of planting, date of first fruit, total crop, number of crops, and the earliest and latest dates of picking for the varieties of plums in the variety test orchard. Some additional notes are given on variety tests of plums, peaches, and apples. With the peaches and plums, a marked difference in yield has been observed for different trees of the same varieties.

The test of northern *v.* southern Ontario grown potato seed was continued. Generally speaking, the results for the fourth season are again in favor of the northern grown seed. In one case, however, southern Irish Cobbler seed which

was grown late, and was thus immature when harvested for seed, gave a gain of 56.5 bu. per acre over northern seed and a gain of 62 bu. per acre over ordinary southern seed. Northern Green Mountain seed gave gains of 42 bu. per acre over the ordinary southern seed and 25.8 bu. per acre over the immature seed.

The results of an extensive variety test of tomatoes are presented in tabular form. Data are given on variety tests of peaches and strawberries with reference to their value for canning. Other work reported deals with the bottling of sweet cider, canning grape juice, and making asparagus soup stock from waste asparagus.

Intensive cultivation, F. Keeble (*Nature [London], 106 (1920), No. 2661, pp. 293–296*).—An address reviewing the achievements of British horticulture during the war and discussing its immediate prospects.

Amateur gardening month by month, T. W. Sanders (*London: W. H. & L. Collingridge, 1920, pp. 130, pl. 1, figs. 34*).—A calendar of operations for each month of the year in the flower, fruit and vegetable garden, greenhouse, and frame.

Commercial fruit growing, A. Janson (*Der Grossobstbau. Berlin: Paul Parey, 1920, 2. ed., rev., pp. VIII+410, figs. 139*).—A revised and enlarged edition of this work (E. S. R., 24, p. 39), which deals primarily with the economic phases of orcharding.

Growing the home orchard (*Missouri Fruit Sta. Circ. 15 (1918), pp. 8, fig. 1*).—Brief notes on the size and plan of the home orchard, securing stock, planting, and culture are given.

A progress report of fertilizer experiments with fruits, R. C. Collison (*New York State Sta. Bul. 477 (1920), pp. 3–53, figs. 6*).—Continuing earlier work (E. S. R., 25, p. 643; 31, p. 339), experiments on fertilization of apples, pears, cherries, and grapes are summarized in this progress report, covering the years 1912 to 1919. A general plan of fertilizer treatment, based on data showing the quantities of plant food removed by trees and on general practice, was adopted. Records of growth increase and of yields of fruit were taken in all cases.

Three apple orchards were under experiment, located on soils more or less representative of the fruit soils of the State. Two were Baldwin orchards in their prime, the third a young Northern Spy orchard not yet bearing. The two Baldwin orchards have given erratic results in yield and growth, which, together with data on growth from one of the orchards for five years previous to the experiment, "force us to conclude that variations in results as between plats have been due to factors other than fertilizer treatment." In the Northern Spy orchard growth has been generally increased by fertilizers, but rather inconsistently as between different treatments. No significant differences were noted in color and size of fruit.

In a Montmorency cherry orchard on Ontario loam soil "fertilizers have increased yields, this being particularly true of nitrogen and, to a less extent, of phosphorus and potassium. If these increases are calculated to a cost basis, however, fertilization has been made at a loss financially. The growth of the trees has also been increased to some extent by fertilizers."

One young Kieffer pear orchard was fertilized according to the general plan, but since two years' fertilization were omitted from the seven-year period conclusions are deferred.

A young vineyard of Concord grapes of about 4 acres in Chautauqua County was placed under systematic fertilizer treatment in 1913. The plan included previous drainage and soil treatment. General basal soil treatment was empha-

sized rather than the yearly application of fertilizer combinations. Up to the present time the indications are that available nitrogen may be a factor in the vineyard.

Fertilizers were applied to newly budded nursery stock of three varieties, Baldwin, Oldenburg, and McIntosh. "The Baldwins have, in the same period, made larger trees than either Oldenburg or McIntosh. Rock phosphate and manure and rock phosphate and potash have increased the growth of the McIntosh and Baldwin stock. Potash alone apparently increased the growth of McIntosh, but not of Baldwin. Nitrate of soda in no case seems to have increased growth."

Results as a whole in the fertilization of different fruits "have not strengthened the writer's opinion of the value of fertilizer experiments with tree fruits. It was thought that several of the soils used would respond to fertilizer treatment with trees. Possibly the next five years will give more positive results. From the data at hand, one must conclude that, in general, on our better fruit soils differences in growth and yields due to other causes have far outweighed those due to the fertilizer treatments."

Should the orchard be fertilized? J. D. LUCKETT (*New York State Sta. Bul. 477 (1920), pp. 11, figs. 4*).—A populàr edition of the above.

Smoke and direct radiation in frost protection, F. D. YOUNG (*Better Fruit, 15 (1920), No. 6, pp. 5, 6, figs. 2*).—This article is based upon trials of different kinds of orchard heaters at Pomona, Calif., and Medford, Oreg. The principal conclusion drawn is that the chief benefit is derived from the heat directly radiated, and that the heat radiated directly from the heater to the tree is of much greater importance with the high-stack heaters than is the case when other types are used. The high-stack heaters are most efficient when placed in such position as to throw light on the greatest possible area of foliage.

The influence of stock and scion and their relation to one another, S. H. PRAYAG (*Agr. Jour. India, 15 (1920), No. 5, pp. 533–542, pl. 1, fig. 1*).—A paper read at the Seventh Indian Science Congress at Nagpur, in 1920, which summarizes information on the subject derived from investigations with important fruit trees and other plants that have been conducted at the Ganeshkhind Botanical Gardens since 1909. Among the phases considered are preference of some stocks for particular scions; influence of stock on the vigor, habit of growth, and yield of the scion; undesirable combinations of stock and scion; influence of scion on the stock; and grafting between different genera of the same natural order.

The top-working of Indian fruit trees, W. BURNS and P. G. JOSHI (*Agr. Jour. India, 15 (1920), No. 5, pp. 516–520, pls. 3, figs. 2*).—The authors report successful results in top-working fruit trees, principally mangoes, by the seedling-inarch method of propagation used by Oliver (E. S. R., 24, p. 736).

The new system of pruning, L. AUSTIN (*Univ. Calif. Jour. Agr., 6 (1920), No. 8, pp. 8–10, 27, 28, figs. 3*).—A contribution from the University of California. It reviews the results secured by Tufts in long-continued pruning experiments with various young deciduous fruit trees (E. S. R., 42, p. 138), and discusses the application of these results in pruning bearing as well as young trees.

Spray calendar and spray mixtures, F. W. FAUROT (*Missouri Fruit Sta. Circ. 18 (1919), pp. 12, figs. 4*).—A spray calendar for apples, peaches, plums, cherries, grapes, strawberries, raspberries, blackberries, gooseberries, and currants is given, together with notes as to standard insecticides and fungicides and their application.

Small fruits for the home orchard, F. W. FAUROT (*Missouri Fruit Sta. Circ. 14 (1918), pp. 3–8*).—Varieties of grapes, blackberries, raspberries, strawberries, currants, and gooseberries for the home orchard are suggested.

Fruit varieties for western Washington, J. L. STAHL (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 9, pp. 130, 131*).—A revised varietal list of orchard and small fruits recommended for western Washington (E. S. R., 40, p. 694).

Golden Delicious, a surprising apple, E. H. FAVOR (*Amer. Fruit Grower, 40 (1920), No. 11, pp. 3, 4, fig. 1*).—An account of this recently introduced apple, which is said to be not only a remarkably early bearer but also to yield a heavy annual crop. Trees 18 months from planting yielded a commercial crop, and grafts 5 years old have produced four successive crops of apples. Other characteristics attributed to this variety are its apparent resistance to fungus diseases, long keeping quality, hardiness, and desirable flavor and texture.

Cooperative spraying demonstrations in Missouri apple orchards, 1916–1918, T. J. TALBERT (*Missouri Agr. Col. Ext. Circ. 92 (1920), pp. 32, figs. 11*).—This bulletin contains tabular data summarizing the results secured from spraying demonstrations in a large number of Missouri apple orchards, together with recommendations for spraying and information relative to spray mixtures, formulas, and equipment.

Observations on the accumulation of carbon dioxid from strawberries in refrigerator cars, H. F. BERGMAN (*Science, n. ser., 53 (1921), No. 1358, pp. 23, 24*).—During the progress of investigations on shipping strawberries in refrigerator cars, the author made observations on the carbon dioxid and oxygen content of the air in refrigerator cars and the effect of ventilation on the accumulation of carbon dioxid.

It was found that there was no great accumulation of carbon dioxid in the air of the unventilated cars in transit. The maximum amount observed was 2.5 per cent by volume seven hours after the doors of the car were closed. When the car was re-iced the carbon dioxid content dropped to 0.7 per cent. From this it increased again to 1.3 per cent, but at the next icing it dropped to 0.6 per cent and never exceeded this amount during the remainder of the trip.

In ventilated refrigerator cars the percentage of carbon dioxid was lower. The author claims that the accumulation of carbon dioxid, even in unventilated refrigerator cars, is apparently not sufficient to cause any injury to strawberries.

Enological themes, J. ALAZRAQUI (*Univ. Nac. Buenos Aires, Rev. Facult. Agron. y Vet., 3 (1920), No. 1, pp. 3–24*).—A discussion of various economic problems of Argentine viticulture.

The manuring of olives, J. BONNET (*Vie Agr. et Rurale, 9 (1920), No. 50, pp. 373–376, fig. 1*).—A practical discussion of the subject, based upon the results of experimental tests conducted under the direction of the Olive Culture Service at Marseille.

A preliminary note on the improvement of oranges, K. P. SHRIVASTAVA (*Agr. Jour. India, 15 (1920), No. 5, pp. 508–515, pls. 2*).—A paper read at the Seventh Indian Science Congress, at Nagpur, 1920. It summarizes the results of a series of experiments started at the Botanical Garden, Central Provinces, in 1913, and deals with orange stocks and nursery practices; lifting of budded plants, packing, etc.; pruning; manures; and irrigation.

Value of effective windbreak to citrus orchard, J. R. LUNDEMO (*Calif. Citrogr., 6 (1920), No. 3, pp. 76, 91, figs. 4*).—An account of the results obtained from windbreak planting on a 5,000-acre citrus grove near Los Angeles, established during the period 1910–1912.

Complete meterological records have been kept almost since the windbreaks were planted. The first year's records showed an average daily wind velocity

of from 5 to 9 miles an hour. This has dropped each succeeding year until in 1919 it averaged only from 2 to 5 miles an hour. Aside from lessening the velocity of the air currents, thus effecting a saving in mechanical injury to the fruits, the windbreaks have greatly reduced the daily fluctuations in temperature, bettering the growing conditions in the grove. Injury to fruit trees adjacent to windbreaks has been greatly reduced if not overcome by root pruning one side of each windbreak every other year. Of the several varieties of eucalypts used in the windbreaks, the blue gum has proved most satisfactory.

The mango tree, L. PYNAERT (*Bul. Agr. Congo Belge, 10 (1919), No. 1-4, pp. 185-240, figs. 14*).—An account of the mango tree with reference to its history, botany, synonymy, distribution, varieties, climatic and soil requirements, propagation, culture, harvesting, diseases, uses, and marketing. A table is given showing analyses of various mangoes and mango conserves.

FORESTRY.

Growing and planting hardwood seedlings on the farm, C. R. TILLOTSON (*U. S. Dept. Agr., Farmers' Bul. 1123 (1921), pp. 29, figs. 15*).—This compilation discusses what trees to grow; planting two or more kinds of trees together; location of the plantation or windbreak; establishment and care of the plantation; sources of planting stock; seed collection, extraction, and storage; growing the seedlings; and sources of information and advice for the planter. Considerable tabular data are included as to the choice of trees for various purposes, diameter and height growth of hardwood forest trees, hardwood mixtures, spacing for forest trees, sources of planting stock, time of seed ripening, methods of storing tree seed, and the amount of seed to sow.

The windfall problem in the Klamath Region, Oregon, R. H. WEIDMAN (*Jour. Forestry, 18 (1920), No. 8, pp. 837-843*).—A discussion of the cause and effects of windfall, based on the examination of windfall damage on the Crater National Forest.

Chaparral cover, run-off, and erosion, E. N. MUNNS (*Jour. Forestry, 18 (1920), No. 8, pp. 806-814*).—An examination of certain burned-over areas on the Angeles National Forest, with special reference to the increase in soil erosion and a consequent decrease in herbaceous growth.

Second remeasurement of permanent sample plats of Douglas fir on the west slope of the Cascades in Oregon, T. T. MUNGER (*Jour. Forestry, 18 (1920), No. 8, pp. 833-836*).—This report treats of the history and growth of three sample plats of Douglas fir that were established on the Cascade National Forest in 1910. The data secured in 1920 are compared with those secured from previous measurements of the plats.

Utilization of black walnut, W. D. BRUSH (*U. S. Dept. Agr. Bul. 909 (1921), pp. 89, pls. 14, figs. 7*).—This bulletin discusses the properties of black walnut timber, susceptibility to insect and fungus attack, available supply, quality from different regions, demand, and utilization by industries, notably for veneer, furniture, musical instruments, planing-mill products, and general millwork, gunstocks, office fixtures, airplane propellers, etc. Data as to export demands and war time utilization, and a summary of general market conditions are included.

"Although the present very high market price of the timber may not be maintained, walnut will always be in demand and will bring good prices because of the intrinsic value of the wood. Owners of timber tracts containing

walnut will generally find it profitable to favor the young growth of this timber over that of less valuable species."

Selection of a high-yielding strain of Hevea resistant to brown bast, R. D. Rands (*Dept. Landb., Nijv en Handel [Dutch East Indies], Meded Inst. Plantenziekten, No. 42 (1920), pp. 14, figs. 2*).—An account is given of experiments made at Buitenzorg, which resulted in the isolation of a high yielding tree resistant to brown bast. A section of the Economic Garden has been planted with vegetative offspring from this tree for the purpose of future study.

To eliminate otherwise superior trees that are susceptible to brown bast, the trees are tapped five or six times a day. This severe overtapping soon produces brown bast in the susceptible trees, and the trees remaining healthy serve as a source of resistant propagating stock.

Further experiments in salai (Boswellia serrata) tapping in the Shirpur East Range of the N. Khandesh Division, H. W. Starte (*Indian Forester, 46 (1920), No. 11, pp. 578, 579*).—Some data are given on tapping experiments conducted during the six months December, 1918, to May, 1919, inclusive. The results indicate that the yield of gum-oleo-resin is influenced more by the length of the tapping period than by the season of tapping. The best yield was obtained in the fourth month of tapping.

Alinement volume tables, H. Krauch (*Jour. Forestry, 18 (1920), No. 8, pp. 831, 832, fig. 1*).—A brief discussion of the superiority of the alinement volume chart as compared to the alinement volume table. The author concludes that the charts make possible more rapid transcription of volume data, and that there is less chance for error than where mathematical interpolation is made from the regular tables.

A plan for combined insurance and fire protection, D. R. Brewster (*Jour. Forestry, 18 (1920), No. 8, pp. 803–805*).—A paper read before the Madison section of the Society of American Foresters, September 23, 1920, in which the author presents a general plan which it is believed, if adopted in Wisconsin, would make forest protection and insurance practically automatic and self-supporting throughout the State, and at the same time steadily increase the area of timber-producing lands under intensive forest management.

A plan for the advancement of forestry in Wisconsin, D. R. Brewster (*Jour. Forestry, 18 (1920), No. 8, pp. 792–802*).—A paper read before the Madison section of the Society of American Foresters, September 23, 1920, in which the author reviews the forestry situation in Wisconsin and outlines an organization of a forestry council, together with the activities of such a council and specific projects to be worked out.

In the open: The National Forests of Washington (*U. S. Dept. of Agr., Dept. Cir. 138 (1920), pp. 78, pl. 1, figs. 40*).—An account of the recreational features of these forests, with instructions to campers, data on camp cookery, a summary of the 1920 Washington game laws, etc. A map of these areas is appended.

Argentine and Paraguay forest conditions, W. R. Barbour (*Jour. Forestry, 18 (1920), No. 8, pp. 823–830*).—A brief résumé of forest conditions, utilization, and practice in Argentina and Paraguay.

A sketch on Swedish forestry from an American standpoint, H. R. Wickenden (*Jour. Forestry, 18 (1920), No. 8, pp. 775–791*).—In this paper the author briefly sketches the forests and climate of Sweden, forest regulations, the experiment station, forestry practice and organization, the fire law, forest management, estimating and cruising, regulation of cut, rotation, cutting, thinnings, logging, intensive management, reforestation, and the present situation.

DISEASES OF PLANTS.

Heteroecism and specialization of Puccinia caricis, J. ERIKSSON (*Rev. Gén. Bot., 32 (1920), No. 373, pp. 15–18*).—Numerous observations are cited showing that in all sections of the collective species *P. caricis* biological races or specialized forms occur, these being adapted individually to parasitism on certain species of Carex without being able to live on others.

Evidence of disease resistance in barley to attacks of Rhynchosporium, A. G. JOHNSON and W. W. MACKIE (*Abs. in Phytopathology, 10 (1920), No. 1, p. 54*).—The authors report the occurrence of the disease of barley and rye caused by *R. secalis* in the upper Mississippi Valley. The disease has been observed in this valley for a number of years, the attacks being rather scattered and only occasionally severe. The authors noted evidence of disease resistance in two varieties of barley grown at Davis, Calif.

The resistance shown by three hard winter wheats to plant diseases, L. E. MELCHERS (*Abs. in Phytopathology, 10 (1920), No. 1, p. 52*).—Attention is called to the resistance of Kanred (P762), P1066, and P1068, products of the Kansas Experiment Station, to stem rust (*Puccinia graminis tritici*). The author claims resistance on the part of these wheats to leaf rust in Kansas. Based on information gathered from various sources, it appears that they are also resistant to stripe rust to some extent and only slightly susceptible to *P. graminis tritici-compacti*. Kanred is also said to show resistance to stinking smut of wheat when compared with a number of other commercial varieties.

The resistance of Kanred (P762), P1066, and P1068, three hard winter wheats, to leaf rust, L. E. MELCHERS and J. H. PARKER (*Abs. in Phytopathology, 10 (1920), No. 1, pp. 52, 53*).—Observations made by the authors during six years are said to have shown that these varieties are markedly resistant to leaf rust under Kansas conditions. Leaf rust is said to have occurred severely in Kansas in 1919, but out of 800 fields of Kanred that were inspected the amount of leaf rust ranged from 8 to 10 per cent, while adjoining fields of other varieties showed from 20 to 100 per cent infection.

Relation between soil moisture and bunt infection in wheat, C. W. HUNGERFORD and A. E. WADE (*Abs. in Phytopathology, 10 (1920), No. 1, p. 53*).—Field observations carried on in Lewis County, Idaho, for four years are said to have shown a close relation between the amount of bunt on winter wheat and the amount of moisture in the soil at the time of planting. Some experiments are reported in which wheat was grown in large containers filled with soil containing different amounts of moisture, and where the soil was heavily smutted and the seed covered with viable spores, the resultant infection was directly in proportion to the amount of moisture present in the soil.

Recent studies on Septoria of wheat, R. O. CROMWELL (*Abs. in Phytopathology, 10 (1920), No. 1, p. 51*).—The author reports that Septoria of wheat in the imperfect stage survives the period from harvest time until the rosette stage of winter wheat is developed. Pycnospores were found to retain viability on the 1919 crop of leaves until early in October. Mature pycnidia were found on volunteer and winter wheat seedlings as early as October 2 and November 1, respectively, and spores were viable on November 10. The maximum and optimum temperatures for germination of pycnospores are 34, and 24 to 28° C., respectively.

The development of loose smut of wheat as modified by soil fertility, F. D. FROMME (*Abs. in Phytopathology, 10 (1920), No. 1, p. 53*).—The author shows that continuous cropping of wheat with varying applications of fertilizers affected the amount of loose smut (*Ustilago tritici*) according to the degree of

soil fertility maintained, the highest percentage of smut being found in plats of low fertility and vice versa. Similar observations were reported with stinking smut (*Tilletia lævis*) in greenhouse plats. It is thought probable that the variations are due to the total or partial elimination of the smut fungus by the greater vigor of the growth of the plants on the more fertile soils.

Experiments on the control of stinking smut of wheat, G. H. Coons (*Abs. in Phytopathology, 10 (1920), No. 1, p. 54*).—The author describes different methods of treating seed wheat with formaldehyde for the control of stinking smut. Control was obtained by the soak and skim method. A slight injury is said to accompany the formaldehyde treatment, but unless the strength of the solution is excessive or the covering of the grain prolonged, the reduced germination is offset by the greater growth of stalks.

The effect of temperature and light on Fusarium sp. causing wheat scab, J. MacInnes (*Abs. in Phytopathology, 10 (1920), No. 1, p. 52*).—An investigation made to determine the effect of temperature and light on the species of Fusarium commonly causing wheat scab in Minnesota showed that the minimum temperature for growth was approximately 5° C. (41° F.), the optimum about 25°, and the maximum between 30 and 35°. Field experiments showed that a greater percentage of wheat heads became scabby when the temperature at the time of their emergence from the sheath was about 24.4° than when the temperature was lower. High humidity is considered conducive to the development of the disease.

Both diffuse light and sunlight were found to injure the viability of spores. Only about 1 per cent of the spores from scabby heads which were exposed all winter to light either outside or indoors germinated in the spring. Spores from heads which had been kept in the dark germinated readily.

Injury to seed wheat resulting from drying after disinfection with formaldehyde, A. M. Hurd (*Jour. Agr. Research* [*U. S.*], *20 (1920), No. 3, pp. 209–244, pls. 6, figs. 5*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the author has given an account of investigations on the effect of drying seed immediately after treatment.

No seed injury was found when wheat was treated with either a 0.1 per cent or a 0.2 per cent solution of formaldehyde if the seed was germinated immediately after treatment. If held for several days before sowing, severe injury followed the drying of the seed without thorough aeration during storage. However, if the seed remained damp, it suffered no injury from a 0.1 per cent solution and could be kept indefinitely or until attacked by molds. The injury following treatment is usually cumulative, increasing in degree the longer the seed is stored, and is considered due to a deposit of paraformaldehyde on the seed, which forms as the formaldehyde solution evaporates. This substance, being volatile, is constantly breaking down into formaldehyde gas, and the gas, being thus concentrated and held so close to the seed, penetrates it slowly, probably going into solution in the testa.

The degree of post-treatment injury is said to depend on the atmospheric humidity during the storage period. In atmospheres damper than 70 per cent humidity the treated seed could be kept indefinitely, but where the humidity was 70 per cent and less severe injury took place. Paraformaldehyde was not formed on the evaporation of the solutions in the damper chambers, but it did form in all solutions evaporated in desiccators of 60 per cent humidity or less.

The post-treatment injury can be minimized, according to the author, by spreading the seed so that it dries with a maximum aeration, thus hastening the evaporation of paraformaldehyde and the escape of the gas from around the seed. Barley was found less susceptible to post-treatment injury, probably

by the protection of the glumes. Sorghums, Brown durra, Honey sorgo, and Sudan grass were uninjured upon being stored dry after treatment, even when a 0.2 per cent solution was used. The post-treatment injury from dry storage, it is claimed, can be prevented by washing the seed with water immediately after treatment.

Iron accumulation and mobility in diseased cornstalks, G. N. HOFFER and R. H. CARR (*Abs. in Phytopathology, 10 (1920), No. 1, p. 56*).—The authors state that the internal tissues of each node in a cornstalk can be differentiated into two zones, the upper one functioning in starch accumulation and the growth of the internodes, and the lower where the fibrovascular bundles branch to form the bundles extending into the roots, leaves, and husks of the ears.

Iron and other metallic bases may accumulate in organic combinations, first in the phloem cells, and later in the walls and lumina of the zylem elements. The amounts which accumulate seem to be directly related to the premature dying of the lowest leaves. When cornstalks show the effects of malnutrition and symptoms of root rot infections, the lower zone tissues are frequently brown to brownish-purple discolored. Iron compounds are invariably present in large quantities, and oxidase and catalase activities are greater in the nodes of infected stalks than in those of normal healthy stalks of the same age in the same soil.

By testing stalks showing various symptoms of malnutrition and infection by root and stalk-rot organisms, it was found that water was not conducted in the vessels in the nodes which showed the largest accumulation of iron. It is believed that the metallic bases, especially iron, are responsible for causing changes in the normal functioning of the tissues in the lower zones, first in the translocation of carbohydrates from the leaves to the stem and roots by the phloem elements, and later in the conduction of water and mineral nutrients in the transpiration current.

The hydrogen-ion concentration of the tissues in the lower zone approaches neutrality in the stalks showing disease symptoms of root rot, while in the normal stalks the concentrations approximate those of the internodal tissues.

Corn plants with the upper leaves chlorotic are said to be characterized by low hydrogen-ion concentrations and to contain immobile iron compounds within them. It is claimed that the rate of growth of young plants and the degree of chlorosis may be determined by the relative abilities of the plants to develop and maintain a sufficiently high hydrogen-ion concentration to keep the iron compounds mobile, as occurs in normal green plants.

Corn root and stalk rots, J. R. HOLBERT and G. N. HOFFER (*Abs. in Phytopathology, 10 (1920), No. 1, p. 55*).—Root and stalk rots of corn are reported, the fungi causing them being chiefly species of Fusarium and Gibberella. The common wheat scab organism, *G. saubinetii*, is considered the most common pathogene responsible for the root and stalk rotting of corn plants in the Central States.

The most successful control measure that has thus far been developed is said to be the selection of seed from healthy, vigorous plants. Breeding experiments are being conducted to develop resistant strains and varieties.

Some results of corn root rot work in Ohio, W. G. STOVER (*Abs. in Phytopathology, 10 (1920), No. 1, p. 55*).—A report is given of cooperative work with farmers in several counties in which seed corn was tested for germination and later inspected for root rot. In one instance a planting made from ears which showed Fusarium-like fungi was much poorer than the others. The average yield of the rows planted with ears free of these fungi exceeded those from infected seed by more than 4 bu. per acre.

The purple sheath spot of corn, L. W. DURRELL (*Abs. in Phytopathology, 10 (1920), No. 1, pp. 54, 55*).—The author reports corn commonly affected by a disease producing purple spots and blotches on the leaf sheaths. Dead pollen grains and pollen sacs are found within the leaf sheath, and these are considered to act as media for the development of saprophytic organisms, which later enter the leaf tissues. Sugary secretions of aphis may act in a similar way.

Report of the botany division, H. W. BARRE (*South Carolina Sta. Rpt. 1920, pp. 35–37*).—A summary is given of work carried on in this division during the year, the principal investigations being a study of the influence of the physical factors on the vitality of the cotton anthracnose fungus in the seed. Chemicals, gases, and drying by passing currents of hot air over the seed have been tested, but so far no practical method of seed-treatment control has been developed.

Work on the angular leaf spot of cotton was suspended due to the inability of securing infected seed, but the treatment with sulphuric acid has proved satisfactory in tests conducted in previous years.

The author states that the cooperative breeding work with wilt-resistant cotton has been carried to a point where it is thought that farmers and cotton breeders can maintain the purity and resistance of the varieties developed by the station. As a result the station has discontinued further efforts along this line.

Potato diseases, A. FRANK (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1920), No. 9, pp. 140–142, fig. 1*).—A description is given of the potato scab due to *Actinomyces scabies*, for the control of which the author recommends the treatment of all seed tubers with formaldehyde or mercuric chlorid solutions, the avoidance of the use of fertilizers or other substances known to favor the growth of scab organisms, and the practice of rotation in potato growing.

A histological and physiological study of the bacterial vascular disease of potato tubers, F. STRAŇÁK (*Centbl. Bakt.* [etc.], *2. Abt., 48 (1918), No. 24–25, pp. 520–543, figs. 2*).—In a detailed account of this bacterial vascular disease of potato tubers, it is stated that most of the more resistant varieties show a relatively thick skin, low water content, and high sap acidity, susceptibility being associated also with high content of dry substance.

Raising phloem-necrosis and mosaic free potatoes, and a source of infection whose nature has not yet been elucidated, J. O. BOTJES (*Phytopathology, 10 (1920), No. 1, pp. 48, 49*).—The author describes a method for raising potatoes free from phloem necrosis and mosaic, in which the selection of seed potatoes from healthy plants, wide spacing of the rows and of plants in the rows, and the roguing of all diseased plants are recommended.

Studies with Macrosporium from tomatoes, J. ROSENBAUM (*Phytopathology, 10 (1920), No. 1, pp. 9–22, pls. 2, fig. 1*).—A report is given of investigations on the early blight or "nail-head" spot of tomatoes conducted by the author in Florida, and supplemented by observations on winter-grown tomatoes in Washington, D. C., and New Jersey and a study of specimens received from Texas, Louisiana, Tennessee, and Maryland.

It was found that infection on tomatoes resulting in typical nail-head spots takes place without previous injury to the fruit. The infection, however, takes place only on immature fruit when not more than 6 in. in circumference. Experimental shipments of winter-grown tomatoes together with artificial inoculation experiments on tomato fruit have shown that the spots do not originate in transit on mature fruit picked from an infected field, but that immature fruit picked from an infected field and shipped without delay may develop

the spots in transit. The disease does not spread from one infected fruit to another during transit.

Isolations made from numerous diseased tomato fruit, stems, and leaves have shown that the same kind of a lesion is generally produced by the same Macrosporium, and a comparison of the species appearing on the tomato with that on the potato indicates that typical nail-head spots are caused by a Macrosporium that differs specifically from *M. solani* from the potato. The author considers that the species on the tomato should be referred to as *M. tomato.*

A stem disease occurring in Delaware and a fruit rot of tomatoes in New Jersey are said to be caused by a Macrosporium which resembles *M. solani* in culture, in morphology, and in pathogenicity.

Stripe disease of tomatoes, S. G. Paine and W. F. Bewley (*Jour. Min. Agr. [London], 26 (1920), No. 10, pp. 998–1000*).—Tomato stripe causes much loss in various localities. The plants are generally attacked underground, the organism (closely related to or identical with *Bacillus lathyri*) traveling through the stem in parts adjacent to the vascular bundles and rarely appearing in the wood elements themselves. From the pith the disease passes by way of the medullary rays to the cortex, forming lesions in the outer cells and causing sunken furrows to form at the surface.

Varieties differ as regards susceptibility. Manurial treatment has considerable influence in this regard. Lack of potash and excess of nitrogen lower the resistance of the plant to the organism. Seed from an infected area may contain the bacteria in the glairy seed covering, even when the entire fruit showed no sign of the disease, and in this way the soil and crop may be infected.

Pruning may lead to recovery of a partly diseased plant. Improvement of conditions, so as to produce more hardy development, may check the disease and give a crop of sound fruit.

Results of apple blotch control in southern Ohio, F. H. Beach (*Hoosier Hort., 2 (1920), No. 5, pp. 3–9*).—Apple blotch was reported for 1910 in 7 Ohio counties, for 1911 in 16 counties. The disease has increased continuously since that time in prevalence, being known at present in about 60 of the 88 counties in Ohio. It seems to have spread from the southwestern part of the State and now constitutes a real menace to apple growing throughout this section. On account of a number of susceptible varieties, which are named, and the special attention required for its control, the number of trees lost is considerable.

An account of experimentation states that satisfactory control of severe cases of blotch on the most susceptible varieties was secured in the season of 1919 with 3 : 5 : 50 Bordeaux mixture applied 2, 4, 6, and 10 weeks following the fall of the petals. It appears that 2- and 4-week sprays were most helpful in cleaning up severe cases of blotch on susceptible varieties. Complete covering of all surfaces of fruit, foliage, twigs, and new growth is essential to satisfactory control of the disease. Dormant pruning designed to open up thick portions of the tree and to eliminate dead and cankered wood permits thoroughness of later sprayings with corresponding blotch control. Trees severely infected with blotch cankers and making poor growth are usually benefited greatly by application of a fertilizer containing a quickly available source of nitrogen, such as nitrate of soda, when applied shortly before the opening of the blooms.

Dry lime sulphurs do not control apple scab, W. C. Dutton (*Michigan Sta. Quart. Bul., 3 (1920), No. 2, pp. 55–59, figs. 3*).—A report is given of spraying experiments in which the relative efficiency of standard liquid lime sul-

phur, lime-sulphur paste, and dry lime sulphur used in varying proportions were compared, three applications being made, the first when the blossom buds had separated in the cluster, the second just after the petals had dropped, and the third two weeks after the second application. All spraying was done with spray guns. The results of the experiment are tabulated, from which it appears that in every test the dry lime sulphur failed to control apple scab as well as did the liquid lime sulphur. Dry lime sulphur and barium tetrasulphid are not recommended for use in Michigan for the control of apple scab.

Composition of normal and mottled citrus leaves, W. P. Kelley and A. B. Cummins (*Jour. Agr. Research [U. S.], 20 (1920), No. 3, pp. 161–191*).—In a contribution from the California Experiment Station the authors give some results of a study of the nutrition of citrus trees as related to the condition known as mottle leaf. Analyses have been made of all parts of sound and affected trees, but the present paper deals principally with the results of a study of the leaves. Orange, lemon, and grapefruit leaves were collected at various stages of development and analyzed, and in addition studies were made of the composition of the sap of the orange leaves.

It was found that the composition of orange leaves changes rapidly as growth takes place. As the leaves approach senility just preceding the time of normal dropping, notable amounts of potassium and nitrogen are translocated to the stem or other portions of the tree. A part of the phosphorus used is said to leave the leaf sometime preceding the period of normal maturity. Lemon and grapefruit leaves behave in a somewhat similar manner.

The composition of mottled citrus leaves was found widely different from that of the normal leaves, the difference lying mainly in the smaller calcium content and the greater content of potassium and phosphorus. The sap of a normal orange leaf was found to become increasingly concentrated and acidic as growth proceeded. When the leaves were mature the sap was especially rich in calcium and found to contain fully twice as much of this element as of potassium. The sap of mottled leaves was found to contain subnormal amounts of calcium and fully twice as high concentrations of potassium and phosphorus as normal leaves. Limited studies of leaf spurs on citrus trees are said to indicate that their composition varies from the normal in much the same way as the leaves.

As a result of the authors' investigations it is considered that mottled citrus trees are deficient in calcium, but the cause of the subnormal content of calcium can not be definitely stated. It is thought that as mottled leaves sometimes appear on trees that have been injured by alkali, possibly alterations in permeability have been brought about by the presence of excessive concentrations of salts, or possibly some toxic substance may have prevented the roots from taking up normal amounts of calcium. It is considered that should further studies prove that mottle leaf is a result of an inadequate supply of available calcium, the lack of chlorophyll and its disappearance from the localized areas of the leaves will probably be found to be an indirect rather than a direct effect of the shortage of calcium.

Causes for the production of pathological xylem in the injected trunks of chestnut trees, C. Rumbold (*Phytopathology, 10 (1920), No. 1, pp. 23–34, pls. 2*).—The author reports an examination of tree trunks injected with various chemicals, and claims that frequently the two factors, mechanical severance of vascular tissue and chemical stimulation, act simultaneously in the formation of strands of pathological xylem in the phloem region. Observation also shows that a mechanical obstruction in the vascular tissues results in a more regular formation of strands of xylem cells than when they are caused by chemical stimulation.

Black canker of chestnut, G. B. TRAVERSO (*Riv. Biol., 1 (1919), No. 1, pp. 97–101*).—This is a synthetic review of work reported by Petri (E. S. R., 39, p. 554; 43, p. 448) on the black canker of chestnut.

New hosts of oak root fungus in Humboldt County, [Calif.], E. O. ESSIG (*Calif. Comn. Hort. Mo. Bul., 8 (1919), No. 2, pp. 79, 80*).—Recent investigations indicate that the oak root fungus (*Armillaria mellea*) is to be found in practically all sections of the State, very few trees and shrubs being exempt from its attacks. It is found that roots of wild hazel (*Corylus rostrata californica*) and of redwood, which decays very slowly, may act as hosts for this fungus.

Note on the dying back of sal seedlings, E. A. SMYTHIES (*Indian Forester, 44 (1918), No. 9, pp. 420–422, pl. 1*).—Notes are given of a small experiment carried out to show the proportion of sal seedlings dying back, the period of their dying back, and the effect thereon of light and shade. The period and locality are not regarded as presenting typical conditions. Dying back under heavy shade, though regular and severe through both cold and hot weather, is followed by the appearance of new shoots, so that the final result may be rather advantageous than otherwise.

Spiked sandalwood, C. M. HODGSON (*Indian Forester, 44 (1918), No. 2, pp. 66–71*).—The author details numerous reasons for his conclusion that spike of sandal is not due to fire, Zizyphus, lantana, or any other environmental feature, but that it is an internal disorder due to some organism or else to some physiological peculiarity of the tree. Removal operations followed by recurrence of spike are considered to point to some virus in the plant which is left in the soil on its removal.

Is spike disease of sandal (Santalum album) due to an unbalanced circulation of sap? K. R. VENKATARAMA AYYAR (*Indian Forester, 44 (1918), No. 7, pp. 316–324, pl. 1*).—The arguments advanced by Hole in his contribution, previously noted (E. S. R., 39, p. 255), in support of his view that spike in *S. album* is due primarily to causes producing an unbalanced circulation of sap, are herein examined in view of experimentation as to such possible or alleged causes of spike as isolation of the sandal tree from all potential hosts, injury to the root system, girdling the tree, and exposing to evaporation sandal trees previously buried under other foliage. Observations were made also on trees injured seriously by a violent cyclone in November, 1916, which appeared to produce unbalanced circulation of sap in sandal without producing spike. A very severe test depriving the sandal tree of connecting roots so as to prevent its drawing water supply from any of its many hosts did not develop spike, though it did demonstrate a remarkable degree of vitality and endurance of adverse conditions by sandal. Tests involving exposure and injection with sulphuric acid of the sandal root at various intervals, severance of all root attachments, and removal of haustoria and of ends of lateral roots and rootlets were followed by little or no change in the health conditions of the sandal trees. Practically the same results were observed following the exposure of the trees to fire, to girdling, to release after being covered with creepers or other growths, or to any degree of storm injury.

Spike disease of sandal, R. S. HOLE (*Indian Forester, 44 (1918), No. 7, pp. 325–334, pls. 2*).—The author, noting points raised by Ventkatarama Ayyar in the article above noted, calls attention to his own view, previously stated (E. S. R., 39, p. 255), that the conditions under which carbohydrates accumulate in the leaves and branches (supposedly conditioning spike) should be prolonged in order to produce that effect. Further experimentation is indicated as necessary to clear up the causation of this condition, which is considered as analogous to conditions in certain orchard trees.

Spike disease of sandal, R. S. Hole (*Indian Forester, 44 (1918), No. 10, pp. 461, 462*).—A discussion is given of portions of the contribution noted above.

Spike disease in sandal, H. A. Latham (*Indian Forester, 44 (1918), No. 8, pp. 370–372*).—In support of the suggestions that spike in sandalwood may be due to some such heterœcious fungus as the Uromyces, the author submits data with discussion. On the yellow flaccid leaves recently dead, he found small black bodies. A similar fungus was found on *Zizyphus œnoplia*. The new disease seems to have spread from Coorg and Mysore, in accordance with the observation that it usually appears to have spread from a nucleus.

Cause of the spike disease of sandal (Santalum album), C. E. C. Fischer (*Indian Forester, 44 (1918), No. 12, pp. 570–575*).—The author argues against the view that fire may lead to spike of sandal, and favors the view that spike is caused by ultramicroscopic organisms. The possible agency of insects is also discussed.

Progress of spike investigations in the southern circle, Madras Presidency, during 1917–18, P. M. Lushington (*Indian Forester, 44 (1918), No. 10, pp. 439–460, pls. 2*).—Discussion of the history and development of spike disease of sandal in this region shows that while isolated areas favor the theory of noninfection, the spread of the disease from centers favors the infection theory. Experimentation bearing on these theories is discussed. The progress of spike in individual trees has not yet been adequately studied. Seeds taken from spiked branches usually died, though the few that sprouted produced healthy sandal trees.

Experiments at Komattiyur and Andiappanur gave results entirely opposed to the theory that spike is caused by an unbalanced circulation of sap. Transmission of infection over the long distances observed has not been explained, however. Birds, insects, or flying foxes may act as carriers, but carriage through other plants, such as *Zizyphus œnoplia, Dodonæa viscosa, Argyreia cuneata,* and *Cipadessa fruticosa,* is considered more probable. Spike develops more rapidly in some areas than in others, and is more rapid in seedlings and saplings than in older trees. May to July is the most favorable portion of the year for its extension. Spike does not progress regularly from branch to branch. The preventive measures proposed include mainly isolation and destruction of the trees infected.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Maintenance of the fur supply, N. Dearborn (*U. S. Dept. Agr., Dept. Circ. 135 (1920), pp. 12, pls. 9*).—This account, which was presented at the annual meeting of the American Society of Mammalogists at New York City in May, 1920, directs attention to the great commercial importance of fur, emphasizes the need of maintaining the supply, which lately has been declining at an alarming rate, and points out ways by which this supply may not only be maintained as to quantity but improved as to quality. The subject is discussed from the viewpoint of the farmer, to whom fur-bearing animals, if rightly managed, will be a source of interest and profit.

Index to the genera of birds, R. C. McGregor (*[Philippine] Bur. Sci., Dept. Agr. and Nat. Resources, Pub. 14 (1920), pp. 185; rev. in Auk, 37 (1920), No. 3, pp. 471, 472*).—This index gives 8,839 generic and subgeneric names contained in previous lists and catalogues, of which 2,221 occur in Bonaparte's Conspectus of 1850 and 1865; 5,725 in Gray's Hand-list, 1869–1871; 5,380 in the Catalogue of Birds of the British Museum, 1874–1895; 3,073 in Sharpe's Hand-List, 1899–1909; 5,585 in DuBois's Systema Avium, 1899–1904; and 2,737 in Richmond's

three supplements to Waterhouse. This index will facilitate the location of any generic name in the volumes that are constantly used by workers in taxonomic ornithology. The review is by W. S[tone].'

Food habits of seven species of American shoal-water ducks, D. C. MABBOTT (*U. S. Dept. Agr. Bul. 862 (1920), pp. 67, pls. 7*).—This bulletin, the author of which was killed in action at the battle of St. Mihiel, in September, 1918, presents a technical study of the food habits of seven species of American shoal-water ducks, viz, the gadwall (*Chaulelasmus streperus*), the baldpate (*Mareca americana*), the green-winged teal (*Nettion carolinense*), the blue-winged teal (*Querquedula discors*), the cinnamon teal (*Q. cyanoptera*), the pintail (*Dafila acuta*), and the wood duck (*Aix sponsa*); and includes a brief note on the European widgeon (*M. penelope*), which is a straggler in the United States.

The vegetable food preferences exhibited serve as a guide to certain wild-duck foods that may be propagated when it is sought to increase the numbers of these valuable game ducks either in the wild state or in domestication. The items of animal and vegetable foods identified in the stomachs of the ducks and the number of stomachs in which found are presented in tabular form.

Additional information on wild-duck foods has been given in Bulletins 205 (E. S. R., 33, p. 251) and 465 (E. S. R., 36, p. 753), and food habits of three other species are treated in Bulletin 720 (E. S. R., 40, p. 254).

Economic value of the starling in the United States, E. R. KALMBACH and I. N. GABRIELSON (*U. S. Dept. Agr. Bul. 868 (1921), pp. 66, pls 4, figs. 3*).—This is a report of investigations of *Sturnus vulgaris* by the Bureau of Biological Survey, which were commenced in the spring of 1916. This bird appears to have become established as the result of introductions into Central Park, New York City, from Europe, in 1890 and 1891. By 1916 it had spread as far as southern Vermont and New Hampshire, as far west as Oneida County, N. Y., and into eastern Pennsylvania and eastern Maryland.

During the investigation a total of 2,466 well-filled stomachs was secured for examination, of which 309 were of nestlings. Of these stomachs, 1,250 were collected in Connecticut, 814 in New Jersey, 269 in New York, 62 in Pennsylvania, 43 in Massachusetts, 27 in Rhode Island, and 1 in Delaware. There were also gathered 160 additional stomachs only partially filled with food. A list of items identified in the food contained in these stomachs and the number of stomachs in which each was found is appended.

"Examination of 2,157 stomachs of adult starlings showed that 57 per cent of the annual food was animal and 43 per cent vegetable. During the months from April to November, inclusive, excepting July, animal matter made up more than half the food, the maximum being taken in April and May (91.22 per cent and 94.95 per cent, respectively). In July, with the great abundance of mulberries and cherries offering an unlimited supply of luscious fruit, of the 52.67 per cent vegetable matter taken, nearly all, or 50.74 per cent of the total, consisted of those two items. In February, animal food dropped to the lowest point in the year, 28.17 per cent. The average, however, for the four winter months from December to March was 31.5 per cent."

"As an effective destroyer of terrestrial insects, including such pests as cutworms, grasshoppers, and weevils, the starling has few equals among the bird population of the northeastern United States." "Of the total yearly food of the adult starling, 41.55 per cent is composed of insects, a greater proportion than is shown in the food of most of our native birds of similar habits. . . .

"Compared with the 338 stomachs of adult starlings collected in May and June, it is found that the percentage of animal matter eaten by nestlings is

somewhat greater, 95.06 per cent in place of 82.36. By far the largest animal item consisted of caterpillars, which along with a few moths and a cocoon or two, formed 38.21 per cent of the food of young starlings and were present in 274 of the 325 stomachs examined. . . . It is apparent that the habits of the young materially raise the starling's economic status in the early summer months. . . .

"Most of the starling's food habits have been demonstrated to be either beneficial to man or of a neutral character. Furthermore, it has been found that the time the bird spends in destroying crops or in molesting other birds is extremely short compared with the endless hours it spends searching for insects or feeding on wild fruits. Nevertheless, no policy would be sound which would give the bird absolute protection and afford no relief to the farmer whose crops are threatened by a local overabundance of the species. Consequently, the enactment of laws that afford protection to the starling, except when it is actually doing or threatening to inflict damage, appears to be the wisest procedure. With its ready ability to adapt itself to new environments, the starling possesses almost unlimited capacity for good, but it is potentially harmful in that its gregarious habits may abnormally emphasize some minor food habit which would be indulged in at the expense of growing crops. The individual farmer will be well rewarded by allowing a reasonable number of starlings to conduct their nesting operations on the farm. Later in the season a little vigilance will prevent these easily frightened birds from exacting an unfair toll for services rendered."

Entomology, C. T. VORHIES (*Arizona Sta. Rpt. 1919, pp. 437, 438*).—This is a brief statement of the work of the year. The principal activity during the summer and autumn months consisted in investigations of grazing range rodents, with special reference to the large kangaroo rat (*Dipodomys spectabilis*), and of the distribution of the Arizona wild cotton and the native boll weevil which lives upon it, with special reference to the possible future bearing upon the extension of the area of cultivated cotton up the Santa Cruz and Rillito Valleys. A small beetle, provisionally identified as *Blapstinus pimalis*, was a source of injury to cotton at the Mesa Experiment Farm due to its feeding, just below the surface of the soil, on the seedlings as they emerged from the ground. The corn-stalk borer mentioned in the previous report is said to have been identified as *Diatræa lineola*, a species not hitherto regarded as an economic insect.

[Report on entomological work in British Guiana in 1918], G. E. BODKIN (*Brit. Guiana Dept. Sci. and Agr. Rpt., 1918, pp. 54–62*).—This report deals with the occurrence of and control work with the more important insect enemies of crops.

Report of the entomological section. C. R. WIMSHURST (*[Mesopotamia] Agr. Dir. Admin. Rpt., 1919, pp. 39–41*).—This report by the Government entomologist of Mesopotamia records the more important insect pests of the year occurring on dates, cotton, wheat, peach and nectarine, etc.

Wild hawthorns as hosts of apple, pear, and quince pests, W. H. WELLHOUSE (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 388–391*).—A brief account is given of the more imporant insects which now develop on Cratægus, or hawthorn, but which may later attack cultivated fruits.

The squash bug, F. M. WADLEY (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 416–425*).—This is a report of studies of the squash bug by an agent of the Bureau of Entomology, U. S. Department of Agriculture, at Wichita, Kans., during the years 1916–1918, and at Muscatine, Iowa, in 1919. The studies relate to its development, seasonal history, natural checks, and control.

The southern green stink bug in Florida, C. J. DRAKE (*Fla. Plant Bd. Quart. Bul., 4 (1920), No. 3, pp. 41–94, figs. 33*).—This is a summary of the present status of knowledge of *Nezara viridula* L. in Florida, based upon a review of the literature and investigations conducted at Gainesville, Fla. The author deals with its history, classification, distribution, food plants, nature of injury, economic importance, life history and habits, and natural and artificial control. It is an important enemy of garden, truck, soiling, and cover crops, and in fall and early winter sometimes becomes a serious pest in citrus groves, feeding especially upon the fruit, young seedlings, and young shoots of the older trees. Similar infestations have been reported for pecan groves.

At Gainesville hibernation is imperfect, about one-half of the individuals remaining upon succulent plants in the field throughout the winter months. Eggs have been found outdoors the second week in April and as late as December 12, being deposited in clusters, mostly on the underside of the leaves, as many as three clusters, with a total of 212 eggs, having been deposited by a single female. The minimum period of incubation was 4 days and the minimum time for the completion of the five nymphal instars 24 days, or a total of 28 days from oviposition to the appearance of the adult. The records indicate that there are about four generations annually at Gainesville, and probably five in the southern part of the State.

Of its predacious enemies, the Florida predacious bug (*Euthyrhynchus floridanus* is the most important. Two undescribed egg parasites, which were not common at Gainesville, have been reared, also three parasites of the adults. Of 800 individuals collected in the field during the latter part of May and the first of June, 38 per cent were killed by two dipterous parasites, of which 31 per cent were destroyed by a tachinid (*Trichopoda pennipes*) and 7 per cent by a sarcophagid (*Sarcophaga sternodontis*). When valuable garden and truck crops are heavily infested, hand collection seems to be the best control method. In severe infestations in citrus groves collection by large nets can be done successfully and profitably, as described by Watson in an account previously noted (E. S. R., 39, p. 557).

A list is given of 37 references to the literature cited.

Injuries in beans in the pod by hemipterous insects, I. M. HAWLEY (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 415, 416, pl. 1*).—Injury to beans in New York, varying from circular depressed areas with a dark spot in the center to ragged holes in which the bean coat is badly ruptured, to which scars the name "dimples" has been applied, has been found to be due to the feeding of *Adelphocorus rapidus* Say. The seed is stunted when punctured, and the growth around the injured portion produces the dimple. The spined tobacco bug (*Euschistus variolarius* P. deB.) and the tarnished plant bug are said to produce pits in beans also.

The life history of the potato leafhopper (Empoasca mali Le B.), F. A. FENTON and A. HARTZELL (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 400–408, fig. 1*).—This is a report of biological studies conducted at Ames, Iowa. The authors have found the life cycle, from oviposition to adult, to be as low as 14 days during July, with a maximum of 40 days in September and October.

Control of the potato leafhopper (Empoasca mali Le B.) and prevention of hopperburn, J. E. DUDLEY, JR. (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 408–415, pl. 1*).—The author, an agent of the Bureau of Entomology, U. S. Department of Agriculture, reports upon field observations of this pest in Wisconsin and the results obtained in control work. Kerosene emulsion, nicotine sulphate, and Bordeaux mixture were tested, Bordeaux giving by far the best results in leafhopper control and disease prevention. While Bordeaux combined

with nicotine gave better results than when used alone, the excellent results secured by Bordeaux used alone renders it doubtful whether a combination will be necessary.

New parasites for leafhopper found, F. A. G. Muir (*Honolulu Star-Bul.; also in La. Planter, 65 (1920), No. 16, pp. 251, 252, figs. 2*).—The carabid beetle *Drypta australis*, which devours the young and adults of the sugar cane leafhopper (*Perkinsiella saccharicida*) in Australia, was introduced into the Hawaiian Islands in 1919. The author has discovered in investigations in sugar cane fields in northern Queensland that egg parasites are not of first importance in keeping the leafhopper in check, but that the principal agent is *Cyrtorhinus mundulus*, a small hemipteran which feeds upon the contents of the eggs of the leafhopper. This predacious bug can withstand the cyclonic storms that periodically sweep over northern Queensland and also the droughts that at times visit that district, and should therefore be able to stand the much milder conditions obtaining in the Hawaiian Islands. This predator has been introduced and is now being reared in Hawaii, several large colonies having been liberated and the young of the next generation discovered.

On a reaction of the micronucleocytes of brown-tail moth caterpillars infected by the Bacillus melolonthæ liquefaciens, A. Paillot (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 15, pp. 615–617*).—A toxin formed by this bacillus appears to bring about a marked protoplasmic reaction of the micronucleocytes in the blood of the brown-tail moth caterpillars. The majority of the micronucleocytes resist the action of the toxin and more or less quickly regain their normal aspect. The toxin is very sensitive to the action of heat, being almost completely destroyed by prolonged heating at a temperature of 53 to 55° C.

Catalogue of the Lepidoptera Phalænæ in the British Museum, III.—Catalogue of the Lithosiadæ (Arctianæ) and Phalænoididæ in the collection of the British Museum, G. F. Hampson (*London: Printed by Order of Trustees [British Mus.], 1920, vol. 3, Sup. vol. 2, pp. XXIII+619, figs. 112; 1920, vol. 3, Sup. vol. 2, pls. 30*).—This supplement to the Arctiidæ in volume 3 (i. e., Lithosiadæ) adds 25 genera and 1,215 species. The Agaristidæ, for which the name Phalænoididæ is substituted, are increased by 7 genera and 80 species.

Report of entomological section, H. L. Dutt (*Bihar and Orissa Agr. Dept., Expt. Farms and Sci. Sects. Rpts., 1919, pp. 10–12*).—This report deals particularly with investigations of an effective braconid parasite of *Agrotis ypsilon*, which belongs to the genus Microgaster.

This parasite increases rapidly, and by December parasitizes from 30 to 70 per cent of the second or destructive brood of the caterpillar pest. As with its host the parasite is active in winter, and its life history has been completely worked out at Sabour. In January and February the egg and larval stages were passed in a period of 25 days, after which time the period is gradually reduced to 17 days in March and to 12 days in April. It æstivates in the pupal stage. In control work with *A. ypsilon* a large number of the moths were collected by means of traps.

Observations on the structure and coloration of the larval corn earworm (Chloridea obsoleta), the bud worm (C. virescens), and a few other lepidopterous larvæ, H. Garman (*Kentucky Sta. Bul. 227 (1920), pp. 55–84, pls. 12, figs. 3*).—In this bulletin the author considers the microscopic structure of the cuticle of larval Noctuidæ, the setæ and punctures of larval *C. obsoleta* and *C. virescens* compared with those of a few other genera, the microscopic setæ of Chloridea and related genera, setæ of larval *Phlegethontius sexta* compared

with those of Chloridea, the spiracles of larval *C. obsoleta* and *C. virescens*, the recently hatched larva of *C. obsoleta*, the pigment pattern in the larval corn earworm and related insects, the true colors of larvæ of *C. obsoleta* and *C. virescens*, the differences in color between larval *C. obsoleta* and *C. virescens*, examples showing the extent of variation in larval *C. obsoleta*, examples showing the extent of variation in larval *C. virescens*, a summary of differences between larval *C. obsoleta* and *C. virescens*, the phlox-eating Chloridea (*C. phloxiphaga*), and the genus Chloridea.

Broom corn, the probable host in which Pyrausta nubilalis Hubn. reached America, H. E. Smith (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 425–430*).—Evidence is presented by an agent of the Bureau of Entomology, U. S. Department of Agriculture, to show that the European corn borer was probably introduced in Austro-Hungarian broom corn rather than in hemp, as previously supposed.

Some studies on the effect of arsenical and other insecticides on the larvæ of the oriental peach moth, A. Peterson (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 391–398*).—The studies here reported were conducted by the New Jersey Experiment Stations during the seasons of 1918 and 1919.

The pest occurs in several localities in the State, being particularly abundant in orchards about Red Bank and New Brunswick. In an orchard near Middletown, N. J., some of the trees had over 90 per cent of the twigs injured in 1918, while in 1919 the infestation was approximately 50 per cent less. Twig injury to peach trees has been observed to be most severe during the first three years after the trees are set out, while in orchards of five years or more twig injury is not serious. The first larval injury to twigs in 1919 was observed the first week in June, the first fruit injury the last week in June, and the last fruit infestation on September 10. Fruit injury to peaches has seldom exceeded 10 per cent in any orchard in the State, and in most orchards is much less. The pest has also been observed in the State attacking the fruit of apple and quince trees.

During 1918 a number of infested trees were sprayed with arsenical mixtures of varying strengths, but in no case was there a reduction of more than 50 per cent in the number of infested twigs, and on some trees the number was not appreciably reduced. The data obtained during 1918 relating to the effect of arsenicals and other liquid sprays on larvæ of various sizes, when they are placed on tender growing peach twigs and on immature peaches that have been thoroughly coated with the spray and dust mixtures, are reported in tabular form. In spraying experiments with twigs one or more larvæ were able to penetrate any of the coatings put on new peach shoots and safely reach the center of the treated twig. None of the arsenical sprays used stopped the larvæ from entering, though in a few instances some of the larvæ seemed to be repelled by the poisoned material.

The results obtained in dusting experiments show a very small percentage of kill. A very small percentage of the 2–4 mm. and 5–6 mm. larvæ and none of the 7–9 mm. larvæ were killed by lead arsenate following application to immature peaches at the rate of 2 to 4 lbs. to 50 gal. of water with the addition of casein-lime, 2 lbs. to 50 gal., as a spreader. All larvæ smaller than 4 mm. in length were killed when placed on fruit coated with a fine dust of lead arsenate 1 part and hydrated lime, 5 parts, or lead arsenate 1 part and finely ground sulphur 1 part. A comparison of the experiments where twigs were used with those where peaches were used show the best killing results to have been obtained in the fruit series.

The Anopheles and anopheline waters of Southern Flanders, A. D. Peacock (*Parasitology, 12 (1920), No. 3, pp. 234–251, figs. 2*).—"The commonest anopheline mosquito in the area is *A. maculipennis*. The proportion of anopheline waters in this area reached 14 per cent, i. e., one pool in every seven is anopheline. The number of anopheline waters per square mile reached five. The proportion of anopheline waters with numerous larvæ reached 25 per cent. The degree of anopheline infestation appears to be low absolutely, and in comparison with conditions in subtropical countries very low. Two districts, Moulle and Arques, are exceptionally highly infested for this area. All waters, particularly those with vegetation consisting of grass or algæ, are suspects. An epidemic of malaria is unlikely in this area. Military exigencies permitting, the problem of controlling anophelines in the area ought not to be difficult."

Malaria at home and abroad, S. P. James (*London: John Bale, Sons & Danielson, Ltd., pp. XI+234, pl. 1, figs. 104*).—Included in this work are accounts of the study of mosquitoes, their habits, the detection of the malarial parasite in the mosquito, etc.

Observations on malaria by medical officers of the army and others, edited by R. Ross (*London: [Gt. Brit.] War Off., 1919, pp. 342, pls. 23, figs. 3*).—Included in this publication are Practical Notes on Mosquito Surveys of Camps and Barracks during 1917 and 1918, by A. C. Parsons (pp. 95–131); A Short Report on the Antimalaria Campaign at Taranto during 1918, by J. C. Robertson (pp. 149–177); and Report on Indigenous Malaria and on Malaria Work Performed in Connection with the Troops in England during the Year 1918, by A. Macdonald (pp. 178–258).

Field experiments for the control of the apple maggot, G. W. Herrick (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 384–388*).—Cooperative field experiments conducted in New York during the season of 1919, under the author's direction, are said to corroborate the early results obtained by Illingworth (E. S. R., 29, p. 560). In tests made in one of two orchards near Kinderhook, N. Y., the first on July 3 and the second spray on July 17 and 18. In the other orchard the first spray, consisting of 6 lbs. of arsenate of lead to 100 gal. of water was applied on July 3 and the second spray on July 17 and 18. In the other orchard the first spray, consisting of 3 lbs. of powdered arsenate of lead to 100 gal. of water, was applied on June 30 and the second on July 17. The results obtained were entirely satisfactory, there being a marked reduction in the percentage of maggot-infested apples. It was found that thorough spraying is necessary for the most successful control of the pest.

Catalogue of Oriental and South Asiatic Nemocera, E. Brunetti (*Indian Mus. Rec., 17 (1920), pp. [4]+300*).—This catalogue, preparation of which extended over several years, includes an index to the genera and species.

Bionomics of house flies, I–III, P. R. Awati and C. S. Swaminath (*Indian Jour. Med. Research, 7 (1920), No. 3, pp. 548–567, figs. 2*).—Three papers are here presented as follows: Outdoor Feeding Habits of House Flies with Special Reference to *Musca promisca* (*angustifrons?*), by P. R. Awati (pp. 548-552); Attraction of House Flies to Different Colors, by P. R. Awati (pp. 553–559); and A Preliminary Note on Attraction of House Flies to Certain Fermenting and Putrefying Substances, by P. R. Awati and C. S. Swaminath (pp. 560–567). The investigations have led to the following conclusions:

"*M. divaricata* (*nebulo?*) is most abundantly found in dwelling houses, sweetmeat shops, hotels, on stale human feces, and on human feces mixed with other matter. *M. promisca* (*angustifrons?*) is mostly attracted to fresh human feces. It is also found in sweetmeat shops, though in comparatively small numbers.

"House flies do respond to different colors. Whether this is a true color preference or dependent on relative intensity of the colors has not yet been investigated. Yellow has the greatest attraction, red and violet the least; blue, green, and orange are intermediate. There is no evidence forthcoming to show that females and males are differentiated in any marked degree in their response to various colors. Response to colors by house flies is identical by day and by night.

"Some strong-smelling substances connected with putrefaction, such as ammonia, sulphuretted hydrogen, smelling organic compounds of phosphorus, etc., may be necessary to attract flies before they approach what is otherwise a satisfactory food. Alkalinity or acidity of a fermenting or putrefying mixture has nothing to do with attraction of flies. In none of the substances have house flies laid eggs."

The prevalence of Phormia azurea Fallen (larva parasitic on nestling birds) in the Puget Sound region and data on two undescribed flies of similar habit, O. E. PLATH (*Ann. Ent. Soc. Amer., 12 (1919), No. 4, pp. 373–381*).—This is a report of investigations made in the region of Seattle, Wash., from June 15 to August 1, 1918, in continuation of those made in the San Francisco Bay region, previously noted (E. S. R., 40, p. 647).

Fifty-four bird's nests were examined containing nestlings belonging to 10 different species, of which 33 nests were infested by larvæ of *P. azurea*, 1 by a new species described by C. H. T. Townsend as *P. metallica* (pp. 379, 380) and 6 by those of a new species described by J. M. Aldrich as *Hylemyia nidicola* (pp. 380, 381). The 33 nests infested by larvæ of *P. azurea* contained 111 nestlings, only 2 of which died. The nest infested by larvæ of *P. metallica*, containing 3 nestlings of the western robin, was found to contain 26 larvæ.

The effect of infestation by *H. nidicola* appears to be very different, 4 of these nests containing only the bones and feathers of 9 nearly full-fledged nestlings. From these 4 nests 283 pupæ were taken, nearly all of which later hatched. The remaining 2 nests infested by larvæ of *H. nidicola* were those of a cliff swallow and a yellow warbler and contained 1 and 5 dead nestlings, respectively. Fifty-nine larvæ were picked from the outer surface of the 6 dead birds. While none of the 6 nests infested by larvæ of *H. nidicola* contained any living nestlings when discovered, judging from the small number of dead birds found in most of the nests it appears possible that some of the nestlings may have survived. As regards the relation existing between the dead nestlings and the presence of the larvæ of *H. nidicola*, the author suggests that the young birds may have died from some other cause and that the adult flies were then attracted by the odor of decomposing nestlings to deposit upon them, or that the flies deposited on or near the young birds while the latter were still alive, the larvæ subsequently causing the death of the nestlings by penetrating into their body. Since it is known that the larvæ of certain species of flies belonging to the genera Hylemyia and Mydæa, of the family Anthomyidææ, attack nestling birds in Central and South America, it seems not an improbable assumption that the species is a true parasite.

A large number of a species of bug, probably *Occacus (Acanthia) hirundinis* Jen., related to the common bedbug, were observed in the nests, also numerous flea larvæ.

The Pacific oak twig-girdler [Agrilus angelicus Horn], H. E. BURKE (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 379–384*).—This twig girdler is a serious enemy of the California live oak, one of the most important and characteristic native shade trees of the coast valleys of that State. In an account of this pest in 1914 by Childs (E. S. R., 31, p. 60), it was referred to as *A. politus* Say,

from which it is quite distinct. This or a very similar species is said to live in the manzanita and the madrone in the Sierras and coast valleys of central California.

The following host plants have been determined: California live oak, interior live oak, leather oak, canyon live oak, Engelmann or mesa oak, California black oak, and tan oak. The species range from a few feet above sea level to an altitude of 6,000 ft.

It is said to be a two-year species, there being no brood of beetles during the alternate year in many localities. Nine species of hymenopterous parasites have been reared from larval mines and pupal cells, one of which has been described by Cushman[1] as representing a new genus and species (*Cryptohelcostizus rufigaster* Cushman) and three are new species. Pruning of infested twigs is said to be the best method of control that has been developed.

Bean ladybird, W. E. HINDS (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 430, 431*).—The discovery in July, 1920, of *Epilachna corrupta* Muls. in Alabama is recorded. Scouting work in August has shown it to occur throughout Jefferson County and to extend into adjacent counties, particularly southwestward to Bibb County. It appears to have been first noticed in Bibb County in July, 1918, and in Jefferson County at Birmingham in July, 1919. This is its first appearance east of the Mississippi River.

Dipping tobacco plants at transplanting time for the control of the tobacco flea-beetle (Epitrix parvula Fab.), Z. P. METCALF (*Jour. Econ. Ent., 13 (1920), No. 5, pp. 398–400*).—The serious injury caused by flea-beetles to young, transplanted tobacco plants led to the experiments here briefly reported. The results obtained lead the author to recommend that the plants be dipped in arsenate of lead, 1 lb. powder or 2 lbs. paste, to 10 gal. of water.

A blossom-destroying beetle on the mango, G. F. MOZNETTE (*Fla. Plant Bd. Quart. Bul., 4 (1920), No. 3, pp. 95–98, fig. 1*).—*Anomala undulata* Mels. is a source of injury to the mango in Florida in the section of Dade County south of Miami. The beetle attacks all portions of the blossom spike, and in many instances completely girdles or cuts it off. It has also been observed defoliating beans at Redlands, Fla. It has been found stripping the leaves from plum and pear trees in Ohio, and from cherry trees in Illinois, and has been reported as frequently injurious to wheat and other grains in Kansas.

The best method of control consists in the application of an arsenical spray to the blossom spikes. Applications consisting of 2 lbs. of either powdered arsenite of zinc or arsenate of lead to 50 gal. of diluted Bordeaux mixture will either destroy the pest or act as a repellent.

Entomology, A. F. CONRADI (*South Carolina Sta. Rpt. 1920, p. 42*).—Observations were made during the winter on the hibernation of the boll weevil in a large cage on Edisto Island. Data on the boll weevil collected during the year indicate that the period from emergence of the adults to oviposition averages 7.5 days, and the period from egg laying to the emergence of adults is 17.5 days, or a total of 25 days for the completion of the life cycle under South Carolina conditions.

Clover leaf weevil, D. G. TOWER and F. A. FENTON (*U. S. Dept. Agr. Bul. 922 (1920), pp. 18, figs. 9*).—This is an account of the status of knowledge of (*Phytonomus*) *Hypera punctata* Fab., based upon a review of the literature and investigations conducted by the authors, in large part at Lafayette, Ind.

The species, which ranks as one of the most important clover pests, was introduced accidentally into the United States from Europe, where it is well known. It was first recorded as a pest in this country in 1881, when a severe

[1] U. S. Natl. Mus. Proc., 55 (1917), pp. 534, 535.

outbreak occurred at Barrington, N. Y., and has spread, now occurring as far west as Washington, Oregon, Idaho, Kansas, and Texas. Technical descriptions of its several stages are given, which are said to have been taken largely from the synopsis by Titus, previously noted (E. S. R., 27, p. 259). The authors' studies show the life cycle to be one year, thus confirming the results obtained by Folsom (E. S. R., 21, p. 453).

The results of the life history studies at Lafayette are graphically illustrated in the accompanying diagram:

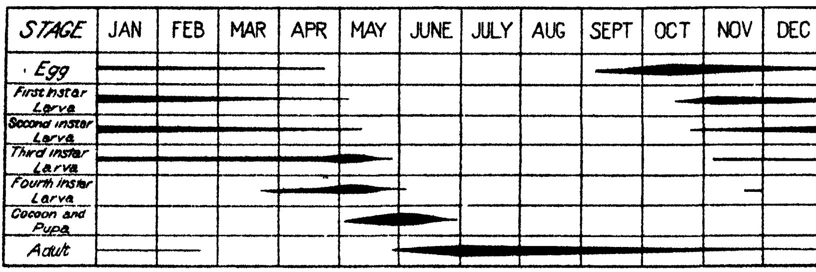

FIG. 1.—Diagram illustrating life history of the clover-leaf weevil and indicating the abundance of the different stages during the season in the latitude of La Fayette, Ind.

Feeding experiments conducted at Lafayette to determine the amount of clover foliage consumed by larvæ in their different instars, and by the adults during the different months, are diagrammatically illustrated.

The disease caused by the fungus *Empusa sphærosperma* Fres. is the most important check. Mention is made of several natural enemies, and a list is given of 17 birds known to feed on this weevil. The outbreaks of this insect are eventually suppressed by the fungus disease above mentioned and, except in rare cases, before serious damage is done.

Beekeeping, A. F. CONRADI (*South Carolina Sta. Rpt. 1920, p. 43*).—This is a brief summary of the work of the year with bees. The results obtained at the experimental apiary at Clemson College show the great value of winter packing when properly carried out. The results obtained thus far have led to the recommendation that the aluminum comb be generally adopted in the State.

The web-spinning sawfly of plums and sand cherries (Neurotoma inconspicua Nor.), H. C. SEVERIN (*South Dakota Sta. Bul. 190 (1920), pp. 221–251, figs. 13*).—The webbing sawfly, first described by Norton in 1869 as *Lyda inconspicua*, is distributed generally over South Dakota, being most abundant in the eastern third of the State. It has also been found in the neighboring States, has been reported as occurring in Massachusetts, and is a serious pest in southern Manitoba.

The larvæ are gregarious and live and feed in webs which they spin about the leaves and twigs of their food plants. The foliage of plum trees and sand cherry bushes constitutes the preferred food of the pest, and such trees and bushes may be entirely defoliated during June and July. The adults make their appearance during the latter part of May or early June, and after mating each female lays about 46 eggs (average of 40 females), which hatch in from 5 to 7 days. The larvæ feed for 13 to 23 days, at the end of which time they fall to the ground and enter it to a depth of 1 to 10.5 in. and hollow out cells inside of which they pass the remainder of the summer and all of the fall, winter, and early spring. With the approach of warm weather they change to pupæ, and after 7 to 10 days the adults appear, there being but one generation a year.

Three parasites of this sawfly were observed, including a tachinid (*Eubrachymera debilis* Town.), an unidentified fungus, and an unidentified mite, which, as well as a number of predacious enemies listed, while effective, do not control the pest. As a control measure the author recommends the use of 1 lb. of lead arsenate in paste form or 0.5 lb. in powdered form for each 50 gal. of water if used as a spray, and 1 lb. of powdered lead arsenate diluted with 15 lbs. of air-slacked lime or powdered sulphur applied as a dust. The arsenical should be applied to the trees or bushes while the webs of the pest are still small.

FOODS—HUMAN NUTRITION.

Textbook on physiological chemistry.—I, The organic nutrients and their behavior in cell metabolism, E. Abderhalden (*Lehrbuch der Physiologischen Chemie.—1. Teil, Die Organischen Nahrungsstoffe und ihr Verhalten im Zellstoffwechsel. Berlin and Vienna: Urban & Schwarzenberg, 1920, vol. 1, 4. ed., rev., pp. VIII+799*).—This is a revision of part 1 of the textbook previously noted (E. S. R., 31, p. 361).

The essentials of chemical physiology, W. D. Halliburton (*London and New York: Longmans, Green & Co., 1919, 10. ed., pp. XI+324, pl. 1, figs. 71*).—This is the tenth revised edition of the book previously noted (E. S. R., 37, p. 501).

International catalogue of scientific literature.—Q, Physiology.—QR, Serum physiology (*Internatl. Cat. Sci. Lit., 13 (1920), pp. VIII+937+V+138+30*).—This continues the series previously noted (E. S. R., 40, p. 869), the literature indexed being mainly that of 1913.

Biochemical studies on marine organisms.—I, The occurrence of copper, W. C. Rose and M. Bodansky (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 99–112*).—Data are presented which indicate that copper is a normal and possibly an essential constituent not only of mollusks and arthropods but of the tissues of marine fish as well.

In oysters the copper was found rather uniformly distributed throughout the tissues except in the muscle, where only half as much was found as elsewhere. The average copper content in the oyster was 34.7 mg. per kilogram and in fish approximately 2.5 mg. per kilogram.

The Maine sardine industry, F. C. Weber, H. W. Houghton, and J. B. Wilson (*U. S. Dept. Agr. Bul. 908 (1921), pp. 127, pls. 23, figs. 2*).—This bulletin is a complete report of extensive investigations on the canning of sardines on the coast of Maine, with suggestions for improving faulty methods, for the elimination of all unnecessary waste, and for the economical utilization of the necessary waste. Various studies in the course of the investigation have been previously noted from other sources, including papers by Obst (E. S. R., 40, p. 555) and by Weber and Wilson (E. S. R., 40, p. 411; 43, p. 111).

The publication is abundantly illustrated with photographs of the various stages of the industry and of samples of the packed product illustrating good and bad conditions. A bibliography of 40 literature references is appended.

Bacterial groups in decomposing salmon, A. C. Hunter (*Jour. Bact., 5 (1920), No. 6, pp. 543–552*).—In continuation of the investigation previously noted (E. S. R., 44, p. 62), a detailed study has been made of the organisms found in decaying salmon.

Out of 300 cultures isolated, 43 were considered significant in that they produced indol or foul odors when grown in a specially prepared fish medium. On identification 21 of these cultures were found to belong to the colon cloacae group, one resembled *Bacterium alcaligenes* and three *B. formosum*, six pro-

duced pigment, and 12 not identified to type evidently belonged to a group of water and soil bacteria which have not been adequately studied.

In general, the bacteria isolated were those described in the literature as water, sewage, and soil organisms. These, accumulating in the gills and mouth and on the skin of the fish, bring about a slow decomposition of the fish after death.

Substitutes for sucrose in curing meats, R. HOAGLAND (*U. S. Dept. Agr. Bul. 928* (*1921*), *pp. 28*).—To determine the possibility of effecting economy in the use of sugar in curing meats, a series of experiments was conducted at three large and one small meat packing establishments on the curing of several classes of meats with a number of sugar substitutes. The meats tested were pork and beef hams, and sweet-pickle and box-cured bacon, and the sugar substitutes dextrose, cerelose, 70 per cent corn sugar, and refiners' sirup. At each of the plants one package of meat was cured with sugar according to the regular practice of the establishment, and one package each was cured by the use of an equivalent amount of the different sugars under investigation, the subsequent soaking and smoking being carried out according to the regular methods. When finished, samples of the product and of the pickle were analyzed, and the quality of the meat was tested by several individuals using a more or less uniform method of scoring, depending upon the appearance and taste of the fried or broiled product.

In the curing of pork hams but little difference was noted in the quality of the hams cured with the several sugars. Sweet pickle bacon cured with the three corn sugars was considered to be of slightly better quality than that cured with cane sugar or refiners' sirup. The opinions concerning the quality of the box-cured bacon were conflicting. The tests conducted by the Department showed little difference in quality of the bacon cured with dextrose and cerelose as compared with that cured by cane sugar, while the tests conducted at two of the establishments showed that the product cured with cane sugar was of distinctly better quality. In curing beef hams dextrose and cerelose yielded dried beef of as good quality as that obtained with cane sugar, while 70 per cent corn sugar and refiners' sirup yielded products of inferior quality.

The analyses of the various brines showed a large percentage of the sugars as well as the added salts originally present in the new pickle to be present in the old pickle, thus showing that considerable economy can be effected by making use of the old pickle.

"The experiments reported in this paper must be regarded as of a preliminary nature, and while the results indicate strongly that several corn sugars, as well as refiners' sirup, can be used successfully as substitutes for cane sugar (sucrose) in curing meats, yet it is highly advisable that meat-packing establishments contemplating the use of one or more of these substitutes first conduct curing tests on a moderate scale before curing large quantities of meat with the sugar substitutes chosen."

Substitutes for sucrose in curing meats, R. HOAGLAND (*Butchers' Advocate, 70* (*1921*), *Nos. 18, pp. 22–24; 19, pp. 22, 23*).—Essentially noted above.

Fermented pickles, E. LEFEVRE (*U. S. Dept. Agr., Farmers' Bul. 1159* (*1920*), *pp. 23*).—This contains a brief description of the processes involved in pickling, together with methods that can be used in the home to prepare the standard varieties of cucumber pickles and sauerkraut, and to preserve other vegetables in a similar way. Tables are included of salt percentages, corresponding salinometer readings, and amount of salt required to make 6 qt. of brine; freezing point of brine at different salt concentrations; the quantity of sugar for each gallon of water to give a sirup of definite degrees Brix or Balling; and the number of pickles of various sizes required to make a gallon.

A bacteriological study of ripe olives, R. C. Rosenberger (*N. Y. Med. Jour., 112 (1920), No. 7, pp. 222–225*).—This is the report of a bacteriological examination of over 250 samples of ripe olives, including olives in bulk and canned and bottled varieties. The study was made under the auspices of the Dairy and Food Commission of Pennsylvania following the outbreaks of botulism which have been previously noted.

No evidence of *Bacillus botulinus* or its toxin was found in any of the olives examined, although many other organisms were present in all preparations. Inoculation of sterile ripe olives with a strain of *B. botulinus* resulted, after anaerobic culture, in the development of a rancid offensive odor.

The heat resistance of spores with special reference to the spores of Bacillus botulinus, H. Weiss (*Jour. Infect. Diseases, 28 (1921), No. 1, pp. 70–92, figs. 14*).—A study is reported of the effect of different factors on the thermal death rate of spores of *B. botulinus*.

A preliminary study of the thermal death rate of 16 different strains of the organism under the best conditions for survival, i. e., in sheep brain medium, showed that the strains varied widely in thermal resistance and that spore resistance was entirely independent of toxin development. The most resistant strain was destroyed within 5 hours at 100° C., within 40 minutes at 105°, and within 6 minutes at 120°.

In the subsequent study of the effect of different factors on the thermal death rate, the spores of a single highly resistant strain were used, all factors except the one in question being kept constant. The results obtained may be summarized as follows:

The more protracted the period of heating before killing of the spore the longer was the period required for vegetation, thus showing that the destruction of the spore is a gradual process, probably due to gradual protein coagulation. A general increase in thermal resistance was noted with aging of the spores, provided the spores were in the same moist condition. The resistance of emulsions of young spores increased, while old spore emulsions were practically unaffected by changes in the number of spores present.

Sodium chlorid lowered the thermal resistance, the rate of lowering increasing rapidly with increase in concentration of the salt. H-ion and OH-ion both lowered the resistance, the rate of reduction decreasing as the H- or OH-ion concentration increased. The H-ion concentration was found to change rapidly in a medium in which *B. botulinus* was growing and ultimately to stabilize itself at a point near a value of pH=7.5.

"In applying these results to the practical problems of processing canned foods, it is necessary to determine the pH value of the material to be sterilized immediately before the exposure. Any delay between the determination and the processing may cause a sufficient change in the pH value to require a higher temperature or a longer period of exposure.

"In all practical processing methods a sufficient safety factor should be allowed. The actual time required in applying such a factor becomes rapidly less as the temperature of processing is increased. Thus, a 50 per cent safety factor applied at a processing temperature of 100° C., the medium to be sterilized having a pH value of 7, would require an extra heating of 60 minutes or a total of 180 minutes. The same safety factor applied at a processing temperature of 120°, the medium to be sterilized being the same, would require an extra heating of 3 minutes or a total of 9 minutes."

The influence of various chemical and physical agencies upon Bacillus botulinus and its spores.—I, Resistance to salt, Z. N. Wyant and R. Normington (*Jour. Bact., 5 (1920), No. 6, pp. 553–557*).—In this paper, which is the

first of a series of studies on the resistance of *B. botulinus* to various agencies, the effect was tested of varying concentrations (1 to 10 per cent) of salt solution upon the growth of 19 strains of *B. botulinus* in a glucose-pork gelatin broth having a reaction of —0.5. The cultures were covered with a layer of sterile paraffin oil and cultivated at room temperature.

Only two out of the entire number of strains failed to show growth at any concentration of salt from 1 to 5 per cent within 7 days, and these 2 showed growth at the end of 27 days. Ten cultures showed growth throughout the entire period of 49 days and at all concentrations of the salt used. These results are thought to indicate that salt is not the inhibiting factor in the destruction of *B. botulinus* and its spores by pickling solutions.

Von Pirquet's feeding system, H. K. Faber (*Amer. Jour. Diseases Children, 19 (1920), No. 6, pp. 478–488*).—This is a description of the Von Pirquet feeding system[1] which was introduced in Vienna early in the European war and is said to have been widely adopted.

The system consists primarily in comparing all foods in actually utilizable calorific value to breast milk of the composition 3.7 per cent fat, 6.7 per cent sugar, and 1.7 per cent protein, or to cow's milk of the composition 3.7 per cent fat, 5 per cent sugar, and 3.3 per cent protein, the total utilizable calorific value being 667 calories per liter in either case. The unit of food value in the elaborate nomenclature worked out by Von Pirquet is the "nem" (Nährungs-Einheit-Milch), representing the calorific value of 1 gm. of standard milk. This, the decinem, and the hektonem are the units most commonly used.

The basis for estimating the food requirements of the individual in this system is the area of the intestine, which is considered to be equal to the square of the sitting height. Estimations of food needs were made by observations of the actual amounts of food consumed under various conditions of life. The minimum intake is defined as the amount of food required by an individual during complete rest in bed to maintain a constant body weight; the optimum intake, as the least amount of food which will permit an infant to perform his usual activities and to gain in weight and to grow at the normal rate, or an adult to perform his customary work while maintaining a constant weight; and the maximum intake, as the greatest amount of food which the intestinal canal can handle without injury. The minimum quota is calculated to be 0.3 nem times the square of the sitting height. Corresponding values for growth, fat deposit, muscular activity, etc., are given, together with examples of the practical application of the system and a discussion of the various points considered in the original publication.

The Pirquet system of nutrition, F. Edelstein and L. Langstein (*Berlin. Klin. Wchnschr., 57 (1920), Nos. 35, pp. 823–826; 36, pp. 852–855*).—A discussion and criticism of the von Pirquet feeding system noted above.

Further contributions to the knowledge of organic foodstuffs with specific action, E. Abderhalden (*Pflüger's Arch. Physiol., 182 (1920), pp. 133–156*).—The author has continued his previous studies (E. S. R., 43, p. 860) by further observations on the effect of feeding pigeons polished rice with or without the addition of small amounts of dried yeast.

Small amounts, 0.5 gm. of the dried material, were sufficient to protect pigeons against polyneuritis when on a polished rice diet. If a larger amount (2.5 gm.) was given, however, the time elapsing after return to a polished rice diet before the appearance of symptoms of polyneuritis was longer. The body temperature of the pigeons on a polished rice diet was consistently lower than that of normal birds. The author is of the opinion that

[1] Von Pirquet, C. F.: System der Ernährung, Berlin: Julius Springer, 1917.

vitamins are essentially regulators of tissue metabolism of the nature of coferments.

The nutritive properties of milk, with special reference to reproduction in the albino rat, H. A. Mattill and R. E. Conklin (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 137–158, figs. 8*).—In an attempt to determine whether cow's milk can serve as an adequate food for the whole span of life, rats taken at weaning were placed on various rations consisting primarily of cow's milk, fresh and desiccated.

On fresh milk the rats made good growth until between the fiftieth and one-hundredth day, when decided retardation took place, particularly in the female, with no reproduction. The addition of yeast filtrate, wheat embryo, or iron citrate increased the rate of growth, but reproduction took place in only one instance and then the litter was eaten. That growth failure on the fresh milk was due partly to the bulk of the food, which necessitated lower intake, was shown by the more satisfactory growth of the animals on whole milk powder. The growth of the female, was, however, retarded after the seventy-fifth day, and no reproduction took place. The addition of 10 per cent of butter fat to the ration was without effect.

On a ration containing 55 per cent of dry whole milk, 40 per cent of starch, and 5 per cent of butter fat, both male and female rats made practically normal growth and the females reproduced but did not raise their young. On a ration of 75 per cent dry milk and 25 per cent lactose poor growth with no reproduction resulted. Examination of the gonads of many of the rats showed a tendency of the ovaries to be much under weight, while the testes with one exception were of normal weight and contained motile spermatozoa.

"Possibly milk is lacking both quantitatively and qualitatively in substances necessary for successful adolescent growth and reproduction, especially in the female, and it may contain substances that are inhibitory to the growth of an animal in the third or mature growth cycle."

A list of 42 literature references on the nutritive efficiency of the various constituents of milk is appended.

The relation of vitamins to the growth of young animals, A. B. Macallum (*Roy. Canad. Inst. Trans., 12 (1920), No. 28, pp. 175–237, figs. 9*).—This paper includes an historical survey of the literature on beriberi and the antineuritic vitamin, scurvy and the antiscorbutic vitamin, and accessory factors as related to growth; and a detailed report of original investigations, some of which have been previously noted from other sources, on growth experiments in rats, particularly as affected by the fat-soluble growth accessory factor, and on the growth-promoting substance in yeast. The conclusions drawn from the results obtained in this investigation are as follows:

"The butter fat, purified by the method of Osborne and Mendel, still contains traces of nitrogenous compounds. The growth factor in the butter fat is unable, alone, to bring about the normal growth increment in young animals. Butter fat shows no nutritive superiority, compared to lard, in feeding experiments of short duration. In prolonged experiments there is a slight improvement as compared with the results obtained with lard.

"Dried yeast preparations contain sufficient quantities of the accessory growth factor to sustain growing animals for a short time. For prolonged feeding experiments, fresh whole yeast or autolyzed yeast liquor is essential for the maintenance of the normal growth rate. The growth-promoting factor can be isolated from hydrolyzed yeast by means of phosphotungstic acid. This method entails a partial diminution in the activity of the growth accessory. It can also be removed from autolyzed yeast with Lloyd's reagent, but larger quantities are necessary than those previously stated as necessary for the re-

moval of the antineuritic vitamin. The accessory growth factor is similar to, and most probably identical with, the beriberi vitamin. Prolonged ingestion of the activated Lloyd reagent causes an inhibitory effect of the growth of the animal, due to toxic properties of the inassimilable silicate."

An extensive list of literature references is appended.

Contribution to the biological action of accessory food substances, E. Freudenberg and P. György (*München. Med. Wchnschr.*, *67* (*1920*), *No. 37*, *pp. 1061*, *1062*).—Attention is called to a previous publication[1] in which the oxygen consumption of calves' intestinal cells in cow's milk (in vitro) were shown to be due to the content of suspended fat droplets in the milk, and further experiments are reported in which the effect of various oils and vegetable extracts on oxygen consumption by rabbit liver cells in Ringer's solution was tested.

It was found that oxygen consumption was greatly increased by the addition of from 2 to 5 per cent of egg yolk, linseed oil, liver oil, neutralized lemon juice, the press juice of carrots, beets, and radishes, and extracts of yeast, and that this property was destroyed or greatly reduced by heating. From the similarity in properties and behavior of these substances to accessory food factors or vitamins, the possibility is suggested of making use of the oxidation reaction as a test for the presence of vitamin in food materials.

A study of the factors which interfere with the use of yeast as a test organism for the antineuritic substance, G. de P. Souza and E. V. McCollum (*Jour. Biol. Chem.*, *44* (*1920*), *No. 1*, *pp. 113–129*).—The authors have subjected the method proposed by Williams (E. S. R., 41, p. 670) for testing the presence of the antineuritic vitamin to a careful examination, using various extracts known by animal experimentation to contain or to be practically free from the vitamin in question. Irregular results obtained when the cultural conditions for each cell were as uniform as possible, and the remarkable effect upon the growth of cells of solutions known to be practically free from this vitamin, such as glucose, digested meat extracts, and wheat germ extracts treated with sodium bicarbonate and autoclaved have led them to conclude that "the use of yeast as a test organism for determining the presence or absence of the antineuritic dietary factor is complicated by so many disturbing factors as to make it of little if any value."

A quantitative method for the determination of vitamin in connection with determinations of vitamin in glandular and other tissues, F. K. Swoboda (*Jour. Biol. Chem.*, *44* (*1920*), *No. 2*, *pp. 531–551*, *figs. 2*).—The method originally proposed by Williams (E. S. R., 41, p. 670) for estimating vitamin-B by the growth of yeast cells has been simplified and improved and is considered to be of quantitative value. The technique of the improved method is described in detail, and the results are reported and discussed of its application in determining the relative vitamin content of the organs of internal secretion, dogs being used in most cases as the experimental animal.

The data presented indicate that the water-soluble vitamin is present in large quantities in most of the organs of internal secretion which are of developmental importance, while in general it is present in much lower concentrations in the other organs examined with the exception of the liver and kidney, which are high in vitamin. Tissues high in nuclear materal, such as the thymus and lymph glands, were found to be low in vitamin content. The fresh pancreas was low in activity, a finding contradictory to the results obtained by Williams and by Eddy (E. S. R., 36, p. 160). As hydrolyzed extracts were used by Eddy and possibly by Williams, the suggestion is made that the pancreas

[1] Freudenberg: Jahrb. Kinderheilk., 91 (1920), p. 201.

may contain a vitamin precursor or vitaminogen, which may be acted upon by acids or ferments to liberate the active growth-promoting substance. In the work with thyroid extracts it was found that in the concentration employed with the other extracts a toxic action was produced, while at low concentrations growth of the yeast cells was promoted. A preparation of the sciatic nerve was also found to contain considerable quantities of the vitamin.

A comparison of these results with the studies of Funk and Douglas on the pathological changes in the glands of internal secretion of polyneuritic pigeons (E. S. R., 33, p. 365) and of Emmett and Allen on rats on a diet lacking in vitamin-B shows that the organs most affected through lack of this vitamin are those in which under normal conditions the vitamin is present in largest quantities. "The finding of vitamin in all these organs seems to indicate the importance of vitamin for growth or sex development."

The effect of cooking on the water-soluble vitamin in carrots and navy beans, E. W. Miller (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 159–173*).—This paper reports a study of the content of water-soluble B in carrots and navy beans. The carrots were cooked at 100° C. for 30 minutes and canned at 10 lbs. pressure for 45 minutes, and the beans were cooked in three ways, in distilled water at 100° for one and one-half hours, in 0.5 per cent sodium bicarbonate solution for 1 hour and 10 minutes, and in distilled water at 120° for 30 minutes. The cooking water was drained off and the vitamin extracted from the solid matter by freezing and expressing the juice. The extract was sterilized by passage through Berkfeld filters, preliminary experiments with yeast having shown that this treatment causes no loss in activity. The vitamin content of the expressed juice and of the previously drained cooking water was determined by the yeast-growth method of Williams as described in the above paper by Swoboda.

While the maximum and minimum growth from single cells in a given experiment showed considerable variation, the averages obtained from a large number of determinations are thought to show a definite quantitative relation between the amount of vitamin added and the growth obtained. From the data the authors conclude that cooking carrots at 100° for 30 minutes or heating at 115° for 45 minutes caused no reduction in the vitamin. Cooking navy beans at 120° for 30 minutes apparently decreased the vitamin content 40.6 per cent, while a loss of 37.5 per cent resulted from cooking the beans in 0.5 per cent sodium bicarbonate for 1 hour and 10 minutes. A large proportion of the vitamin, from 36 to 70 per cent, was found in the cooking water.

Water-soluble B in cabbage and onion, B. K. Whipple (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 175–187*).—A similar study to the one by Miller noted above was made of the effect of cooking upon the water-soluble B content of cabbage and onion, the vitamin in the present study being obtained by repeated extraction with alcohol. The cabbage was tested raw and boiled for 30 minutes in distilled water, in distilled water to which 5 cc. of vinegar had been added, and in distilled water to which 0.1 gm. of baking soda had been added. Onions were tested raw and boiled, and the cooking water from both the cabbage and onions was also tested.

In discussing the data obtained, the author states that "as a strictly quantitative test the method has proved somewhat disappointing. Although duplicate slides and duplicate experiments have sometimes been remarkably consistent in range as well as in average, even here the range within the slide has been large. Within the same drop even, 1 cell may grow to 20 and another to 40. It would seem that the differences in growth of the cells must often be due to a difference in the individual yeast cells themselves. Sometimes they varied in shape and appearance, as has been noted. Then, too, there may be some

difference in the yeast cakes. Other substances may be introduced with the yeast cells."

The results, however, although not strictly quantitative, are thought to indicate that the water-soluble B in cabbage is not destroyed by boiling for from 30 to 60 minutes, with or without the addition of acid or alkali, and that water-soluble B is present in onions and is not destroyed by boiling. It is estimated that not more than one-half of the vitamin is lost in the cooking water from either cabbage or onions boiled for 30 minutes.

The effect of diet on the excretion of indican and the phenols, F. P. UNDERHILL and G. E. SIMPSON (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 69–97*).—This paper gives the results of a study of the urinary excretion of indican and the phenols carried out on three normal individuals and on a dog, the diets being so selected as to offer means of comparison between the results obtained and those obtained by Herter and Kendall (E. S. R., 23, p. 70), Rettger and associates (E. S. R., 33, p. 460), and Torrey (E. S. R., 40, p. 867) in various studies of the effect of diet on the intestinal flora.

The excretion of both indican and phenol was found to vary directly with the protein intake, although in the smaller fluctuations the excretion of phenol and indican did not necessarily vary in the same direction, and in different individuals the relation of phenol to indican excretion was not always the same. Constipation and diuresis tended to cause an increase in the excretion of both indican and phenol.

The diets which gave rise to the excretion of phenols and indican in large amounts were identical with those which the above-mentioned authors had found to promote the growth of putrefactive microorganisms in the intestine. Meat ingested in large quantities caused a marked increase, and casein and glidine (a mixture of wheat proteins) a moderate increase in the excretion of indican and the phenols. Gelatin caused cessation of indican excretion with no change in the excretion of the phenols. The proteins of kidney beans were less completely absorbed than the other proteins and caused a smaller but definite increase in phenol excretion. On a diet containing large amounts of lactose the excretion of indican and phenols was lower than when the diet contained a large amount of protein.

The authors conclude that determinations of both phenols and indican give a good indication of the extent of intestinal putrefaction, and can be used in place of a study of the fecal flora in attempts to regulate the intestinal flora by dieting.

Calcium requirement of maintenance in man, H. C. SHERMAN (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 21–27*).—In this contribution, in which the author has had the cooperation of A. R. Rose and M. S. Rose, data of a considerable number of experiments which supplement the earlier studies on calcium metabolism at the author's laboratory (E. S. R., 24, p. 64; 39, p. 364; 40, p. 174) are summarized and compared with the findings of further observations upon actual food supplies.

The experiments not previously reported include studies of the calcium requirements for maintenance of three healthy men during several 3- to 5-day periods. The indicated calcium requirements of these subjects, together with the data of all available experiments which seemed to be quantitatively comparable, have been computed to a uniform basis of daily calcium output per 70 kg. of body weight. The 97 experiments thus reported showed an extreme range of from 0.27 to 0.82 gm. and an average of 0.45 gm. of calcium per 70 kg. of body weight per day, with a probable error of 0.008 gm., a standard deviation of 0.12 gm., and a coefficient of variation of 27.

Comparing this average with the previously indicated protein requirement of 44 gm., the author concludes that the food supply should contain at least 1 gm. of calcium for every 100 gm. of protein. A comparison of the estimated requirements of calcium and of protein with the amounts furnished in the 224 typical dietary studies previously mentioned (E. S. R., 42, p. 554) showed that the average calcium content in these dietaries (0.74 gm.) was 64 per cent above the estimated minimum, while the average protein content (106 gm.) was 140 per cent above the minimum. Only one of the 224 cases, however, showed less protein than the indicated requirement, while 1 in every 6 was below the indicated requirement of calcium. By raising the amount of food in the dietaries furnishing less than 3,000 calories to that limit, none would have fallen below the standard protein minimum, while 1 in every 14 would still be deficient in calcium.

"There seems to be no room for doubt that more attention should be given to the calcium intake both in human nutrition and that of farm animals. So far as the requirement for calcium in itself is concerned the intake may be supplemented by purely mineral additions, as when the animal feeder includes finely ground rock phosphate ('floats'), bone ash, or oyster shells in the rations which he provides. Similarly calcium carbonate or phosphate might be habitually added to human food, either separately or by mixing it with the table salt used in seasoning; but it would probably be more difficult to persuade people generally to make such additions than to teach a more liberal use of foods naturally rich in calcium, while the latter course has the added advantage that the foods whose larger use would be invoked to increase the calcium intake (notably milk in its various forms) are important sources of proteins of high nutritive efficiency and of the fat-soluble vitamin as well."

Blood regeneration following simple anemia, I–V (*Amer. Jour. Physiol., 53 (1920), No. 2, pp. 151–282*).—Five papers are presented.

I. *Mixed diet reaction*, G. H. Whipple, C. W. Hooper, and F. S. Robscheit (pp. 151–166).—The series of papers of which this is the first deals with the influence of diet factors upon the regeneration of red cells and hemoglobin following simple anemia. Practically all of the experiments were performed upon dogs in normal condition. The anemia was produced by bleeding the dog one-fourth of its determined blood volume on each of two successive days. After hemoglobin and blood cell determinations to estimate the extent of anemia produced, the dog was placed upon a fixed diet and complete blood volume, hemoglobin, and blood cell determinations were made once each week. The tabulated results reported also include the pigment volume, which is the product of the blood volume times the percentage of hemoglobin and indicates the total volume of circulating or effective blood pigment in the blood stream at the time of estimation of blood volume and hemoglobin.

The mixed diet in these experiments consisted of bones, bread, cooked meat, potatoes, rice, macaroni, and general table scraps. Three young dogs were fed this diet ad libitum after anemia had been produced as noted above. All three dogs increased markedly in body weight, the result of general growth and not mere fat production. Complete blood regeneration to normal was effected in a period of from 4 to 7 weeks. In a control fasting animal under similar conditions there was little blood regeneration, this being merely a maintenance factor equivalent to the normal daily wastage of red cells.

II. *Fasting compared with sugar feeding*, G. H. Whipple, C. W. Hooper, and F. S. Robscheit (pp. 167–205).—In this paper it is shown that blood regeneration during fasting periods, although slight as noted above, is distinctly greater than that during a similar period of sugar feeding.

"We believe that this observation may be explained by a double 'sparing action of carbohydrates'—both sparing at the source or protecting body protein from katabolism, as well as effecting synthetically a distinct conservation of protein split products. This postulates a strict conservation by the body of certain protein fractions which may be recast into hemoglobin. The presence of carbohydrate may facilitate this reaction, but the actual new formation of hemoglobin may depend in part upon the type and amount of amino acid groups available from normal protein katabolism.

"Histidin given with sugar appears to cause a production of hemoglobin over the control level. This amino acid may be one of the important elements in this hemoglobin regeneration complex.

"Gliadin in the amounts used does not modify the hemoglobin reaction."

III. *Influence of bread and milk, cracker meal, rice and potato, casein, and gliadin in varying amounts and combinations*, C. W. Hooper, F. S. Robscheit, and G. H. Whipple (pp. 206–235).—The data here presented establish the normal blood regeneration of dogs limited to varying amounts of dried white bread and skim milk, or to some of the constituents of the bread and milk diet. A diet of bread and milk alone in sufficient quantities to maintain or increase body weight was found often to suffice for complete blood regeneration in about 6 weeks, but a restricted diet of the same, barely sufficient for body maintenance, rarely brought about complete blood regeneration. Cracker meal and milk produced about the same effect, while rice, potatoes, and skim milk proved slightly more efficient. Casein and gliadin by themselves were not efficient factors in promoting blood cell regeneration, although casein was the more efficient of the two.

As a result of these observations, a diet of bread and milk in moderate amounts has been used by the authors in succeeding studies as a maintenance diet, to which other factors could be added to test their effect upon blood regeneration. Attention is called to the deficiency disease somewhat resembling scurvy which at times develops in dogs kept on these diets for many weeks, and which can be cured by antiscorbutic measures.

IV. *Influence of meat, liver, and various extractives, alone or combined with standard diets*, G. H. Whipple, F. S. Robscheit, and C. W. Hooper (pp. 236–262).—Cooked liver, lean beef, or beef heart proved very efficient in bringing about rapid blood regeneration following the standard type of secondary anemia. Commercial meat extract was of no value, but an aqueous liver extract and the corresponding liver residue both exerted a definite influence on blood regeneration.

Attention is called to individual differences in reactions of various dogs to a unit type of secondary anemia, particularly to the fact that certain dogs made anemic for the first time present a most unusually rapid regeneration even on a very limited diet. "How to explain this fact is not clear to us, but a simple way out is to assume a reserve present in the body under these conditions which permits of unusual blood regeneration even under most unfavorable diet conditions.

V. *The influence of Blaud's pills and hemoglobin*, C. W. Hooper, F. S. Robscheit, and G. H. Whipple (pp. 263–282).—Inorganic iron given in the form of Blaud's pills in addition to a maintenance diet had no influence in blood regeneration following anemia, thus suggesting that inorganic iron is of no effect in the treatment of secondary anemia. Whole red cells or hemoglobin given by the mouth in the form of a dry powder did not appear to influence profoundly the blood regeneration curve.

"Our experiments show that hemoglobin does have a distinct influence on blood regeneration, but not sufficient to warrant its use in uncomplicated secondary anemia in view of the favorable reactions due to meat and other diet

factors. The favorable reaction which seems to accompany administration of hemoglobin by injection (intravenous and intraperitoneal) may be of some value in the treatment of certain forms of anemia. It is possible that the reaction to this type of injection may differ from that associated with a transfusion, and in certain diseases this procedure (hemoglobin injection) may stimulate rather than depress the bone marrow. Further experimental work is in progress."

Studies in metabolism.—II, The metabolism of a very obese child with a small sella turcica (typus Frölich?), F. B. Talbot (*Amer. Jour. Diseases Children, 20 (1920), No. 4, pp. 331–336, figs. 3*).—The total basal metabolism of a very obese child 2 years and 9 months old and weighing over 54 lbs. was found to be the same as that of boys of the same age, 631 calories. The total metabolism was found to be 37 per cent below the average of boys of the same weight, and the heat production per kilogram of body weight 56 per cent below the average of boys of the same age and 40 per cent below the average of boys of the same weight. The metabolism per square meter of body surface was 41 per cent below the normal of boys of the same age and 32 per cent below the normal of boys of the same weight. On a diet of 895 calories as against the average requirements for his age of 1,200 calories, the child gained in weight, but on receiving 10 gm. of whole pituitary gland daily, he lost weight and began to develop mentally. See also a previous study with a dwarf (E. S. R., 43, p. 368).

ANIMAL PRODUCTION.

Studies on cytolysins.—II, Transmission of induced eye defects, M. F. Guyer and E. A. Smith (*Jour. Expt. Zool., 31 (1920), No. 2, pp. 171–215, pls. 4, figs. 7*).—Continuing the study previously noted (E. S. R., 41, p. 861), the authors report observations on the descendants of rabbits with defective crystalline lenses induced in utero by injections of the mother with fowl serum sensitized to rabbit lens. Several unrelated strains of rabbits were used and the defect, once established, persisted in subsequent generations, often with increased intensity. The defect is considered a specific reaction to the lens antibodies, since the young of pregnant rabbits injected with normal fowl serum or with fowl serum sensitized to rabbit testis did not show the defect.

"In view of the fact that the defects have been carried into the sixth generation by breeding, without any subsequent treatments with the sensitized sera, and, above all, since the modifications have been extracted through the male line, thus eliminating all possibility of the condition in later generations having been due merely to placental transmission from the blood of affected mothers, we feel that the evidence establishes a clear-cut case of inheritance of a specific modification produced by extrinsic factors."

The effect of quinin on the nitrogen content of the egg albumin of ring doves, E. H. Behre and O. Riddle (*Amer. Jour. Physiol., 50 (1919), No. 3, pp. 364–376*).—The authors repeated the experiments of Riddle and Anderson (E. S. R., 40, p. 664) with seven of the ring doves previously used and made nitrogen determinations on the whites of the eggs laid before, during, and after administration of quinin sulphate. It is concluded that the quinin feeding diminishes the nitrogen output of the albumin-secreting gland.

Bacteriological investigations of cellulose digestion, A. Hopffe (*Centbl. Bakt. [etc.], 1. Abt., Orig., 83 (1919), No. 5, pp. 374–386*).—The author has studied the digestive action on filter paper of organisms isolated from the rumen of cattle. Both pure and mixed cultures were used and a wide variety of natural and synthetic media, including the sterilized contents of the rumen.

Of the 33 species isolated only *Bacillus megatherium*, *B. ellenbachensis*, *B. butyricus*, *B. mycoides*, *B. mesentericus vulgatus*, and *Bacterium fluorescens* showed any fermentative action on the cellulose, and this was usually not marked and was generally lost on transfer to new cultures. In no case was the action sufficient to account for the known amount of cellulose splitting that takes place in the animal body, and making allowances for the difficulties of simulating natural conditions in vitro it is suggested that the presence of other organisms, probably protozoa, are necessary for the characteristic cellulose fermentation in the rumen.

On a hitherto unknown cellulose-fermenting Aspergillus (A. cellulosæ) in the digestive tract; its culture and characteristics, A. HOPFFE (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 83* (*1919*), *No. 7, pp. 531–537*).—A mold, *A. cellulosæ* n. sp., isolated from the rumen of cattle was found capable of fermenting cellulose when cultivated at 35 to 37° C. The new species resembled *A. niger* somewhat, but differed markedly from this form in its digestive capabilities.

Experiments to enrich straw concentrate with protein from fungi, H. PRINGSHEIM and S. LICHTENSTEIN (*Cellulosechemie, 1* (*1920*), *No. 4, pp. 29–39, fig. 1, sup. to Papier Fabrik., 18* (*1920*), *No. 29*).—In the authors' experiments hydrolyzed straw (straw concentrate) was spread out in relatively thin layers, flooded with solutions of inorganic nutrients, and seeded with the spores of a mold of the genus Aspergillus. The mycelia permeated the straw, and in about a week the mold was dried and used for feeding. The analysis cited shows that the protein content of the straw had changed from 0.9 to 8 per cent. Digestion trials conducted by K. Thomas with sheep fed the treated straw in conjunction with potatoes or starch indicated that about 40 per cent of the nitrogen of the molded straw was digested. It was found possible to manufacture the product on a commercial scale.

Although the mold was identified by Lindau as *A. fumigatus*, which is generally regarded as pathogenic, no ill effects resulted from feeding the molded straw to cattle, sheep, and rabbits.

The digestibility of berseem (Trifolium alexandrinum), J. A. PRESCOTT (*Sultan. Agr. Soc., Tech. Sect., Bul. 5* (*1920*), *pp. 10*).—The author reports proximate analyses of two varieties of berseem (Egyptian clover) cut at different stages of growth, and digestion trials with sheep fed the fresh-cut forage.

The third cutting of early sown Fahl berseem contained 17.2 per cent dry matter, and the single cutting of a late sowing of this variety contained 27.2 per cent. On the dry basis the former contained 16.83 per cent crude protein, 3.96 per cent ether extract, 21.83 crude fiber, and 11 per cent ash, and the latter 15.25 per cent crude protein, 3.2 per cent ether extract, 24.5 crude fiber, and 8.23 per cent ash. Misqawi berseem contained 15.3 per cent dry matter at the first cutting (January 2) and 24.3 at the fourth (May 21). Between these dates the crude protein content on the dry basis had decreased from 19.9 to 15.65 per cent and the ether extract from 3.98 to 3.22 per cent, while the crude fiber had increased from 18.1 to 25.5 per cent and the ash remained with fair constancy at 13 per cent. The following table summarizes the digestion trials:

Digestibility coefficients for berseem fed to sheep.

Variety fed.	Total organic matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Fahl berseem—early sown	68.1	74.8	59.0	45.6	76.9
Fahl berseem—late sown	63.7	67.6	55.2	47.0	71.3
Misqawi berseem (average of 7 trials)	69.4	73.0	49.9	60.5	74.0

A note on the amount of mineral matter removed from the soil by a crop of berseem is appended.

A comparative study of corn silage in concrete and stave silos, R. H. Shaw and R. P. Norton (*Jour. Dairy Sci., 3 (1920), No. 4, pp. 300–307*).—This is a study of the chemical composition of corn silage from a concrete and a stave silo (capacity 150 tons each) built side by side at the Beltsville Experimental Farm of the Dairy Division of the U. S. Department of Agriculture. Three sacks of cut corn were placed in each silo during the filling process, one close to the wall, one 18 inches away, and one at the center. Electric thermometers were inserted at approximately the same locations. The material in the sacks was used as the source of the samples for analysis. The determinations included moisture, ether extract, total nitrogen, albumin nitrogen, crude fiber, furfurol, total sugars, invert sugars, ash, and volatile acids. There were no differences in temperature or composition which the authors are willing to attribute to differences in the materials used in construction.

Composition of Arizona feeding stuffs, A. E. Vinson, C. N. Catlin, and S. W. Griffin (*Arizona Sta. Rpt. 1919, pp. 411, 412*).—This is a table giving the proximate composition of the following materials: Sorghum silage, feterita silage, darso silage, mixed sorghum and hegari silage, corn silage, alfalfa hay, cowpea hay, wooly foot (*Bouteloua eripoda*), spruce top grama (*B. bromoides*), *B. rothrockii*, *B. curtipendula*, cotton top (*Panicum lacnanthum*), tangle top (*Heteropogon contortus*) *Calycoseris wrightii*, Spanish dagger, elephant grass, *Chætochloa* sp., poppies, poppy pods, Indian wheat (whole plants and seeds), cottonseed meal, barley, cracked milo, and cracked hegari. The protein content in two other samples of grama grass is also given.

Commercial feeding stuffs, A. J. Patten, O. B. Winter, M. L. Grettenberger, and P. O'Meara (*Michigan Sta. Bul. 288 (1920), pp. 75*).—The moisture, protein, fat, and fiber content of 1,011 samples of feeding stuffs collected during 1920 are tabulated. The prices are added in most cases. Materials listed include alfalfa meal, cottonseed meal, cottonseed feed, cottonseed hulls, corn chop, corn germ meal, corn gluten feed, maltose process corn gluten feed, hominy feed, corn feed meal, malt sprouts, dried malt grains, linseed meal, linseed cake, oat hulls, peanut hulls, wheat bran with screenings, middlings with screenings, shorts with screenings, wheat mixed feed, tankage, meat scrap, and various proprietary calf meals, hog, stock, horse, poultry, and rabbit feeds.

Principles of live stock breeding, S. Wright (*U. S. Dept. Agr. Bul. 905 (1920), pp. 67, figs. 25*).—This is a treatise on live stock breeding from the point of view of modern genetics. Topics discussed include reproduction, germ cells in relation to heredity, details of hereditary transmission, the determination of sex, examples of Mendelian heredity in farm animals, heredity of form and function in live stock, systems of breeding, the methods of selection, and the value of purebreds. The problem of inbreeding is discussed in considerable detail, and some results from the author's experiments with inbred guinea pigs are cited.

Essentials of animal breeding, G. M. Rommel (*U. S. Dept. Agr., Farmers' Bul. 1167 (1920), pp. 38, figs. 32*).—This is a popular presentation of the subject, based mainly on material in the bulletin noted above.

The improvement of live stock in relation to the size of the farm, J. Long (*Jour. Bath and West and South. Counties Soc., 5. ser., 14 (1919–20), pp. 60–76*).—The author discusses live stock farming in European countries, and develops the thesis that the preeminence of the British Isles in the establishment of definite breeds has been due to the relatively large area of the individual farm.

Intensive stock raising, A. Gouin and P. Andouard (*Élevage Intensif. Paris: Libr. Agr. Maison Rustique, 1920, pp. [3]+159*).—This volume is intended as a summary of the practical aspects of the work of the senior author on the nutrition of veal calves, fattening steers, and milch cows, carried on for a period of 30 years, and there is also a short chapter on pig feeding. The principles of animal nutrition are outlined, considerable emphasis being placed on mineral requirements. The authors decry the use of starch values in estimating the utility of feeding stuffs, and hold that the method of digestible nutrients gives more accurate results.

Live stock and live stock raising in the Dutch East Indies, H. 'T Hoen (*Veerassen en Veeteelt in Nederlandsch-Indie. Weltevreden, Java: G. Kolff & Co., 1919, pp. 105, pls. 3, figs. 56*).—This is an historical and statistical account of live stock breeding and the kinds of horses, cattle, buffalo, swine, and goats in Java and neighboring islands.

[Live stock in the Dutch East Indies], [P. P.] van der Poel (*Dept. Landb., Nijv. en Handel Nederland. Indië, Jaarb., 1918, pp. 279–322*).—This is a continuation of statistical information previously noted (E. S. R., 41, p. 768).

Investigations in beef production, T. L. Haecker (*Minnesota Sta. Bul. 193 (1920), pp. 5–111, figs. 13*).—This is a study of the composition of steers at successive 100 lb. stages of growth from birth to slaughter, and is based upon the chemical analyses of the bodies of 63 animals and the feeding records of 189 steers. These steers were fed in groups over a number of years, and the methods of feeding have been noted from Bulletin 155 (E. S. R., 35, p. 670). Results are discussed under three headings: (1) The composition of steers at the various stages of growth and fattening, (2) the relation of feed nutrients consumed to substances stored in the body during the various stages of growth and fattening, and (3) nutrient requirements of beef production based upon digestible nutrients. Most of the steers were slaughtered when their weights were close to a multiple of 100 lbs., and in the tables the components are computed to this nearest multiple by assuming that the observed weight of a part or constituent is to the corrected weight as the animal's live weight is to the nearest multiple of 100. Although nitrogen determinations are said to have been made for all the parts, the protein is computed as the difference between the total tissue and the sum of the water, fat, and ash. Complete data are given in 54 tables, and there is an appendix by M. Haggard on the methods of analysis used.

The following table summarizes the data on composition of the body at selected standard weights:

Constituents in a steer's body at different weights and the composition of the tissue gains.

Stage of growth (live weight).	Material in a steer's body.					Composition of gain in tissue.			
	Total tissue.[1]	Water.	Protein.	Fat.	Ash.	Water.	Protein.	Fat.	Ash.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
100	84.85	60.94	16.88	3 41	3.62	71.84	19.89	4.00	4.26
200	157.91	111.23	30.24	9.45	6.99	68.83	18.29	8.27	4.61
400	326.60	214.83	63.08	34.63	14.16	61.42	19.46	14.87	4.25
600	487.05	298.05	94.51	73.30	21.19	51.87	19.58	24.17	4.38
800	679.12	398.78	127.72	125.82	28.80	51.40	17.30	27.34	3.96
1,000	873.57	454.30	149.29	235.40	34.58	29.58	11.10	56.35	2.97
1,200	1,085.84	520.55	173.91	351.26	40.12	31 21	11.61	54.58	2.60
1,500	1,344.90	534.74	211.45	505.60	43.11	24.78	14.49	59.58	1.15

[1] Body weight less contents of alimentary tract.

The data on feed consumption are too comprehensive to summarize. It was found that animals slaughtered at weights of 500 lbs. or less had stored in the body 28 per cent of the digestible crude protein consumed, that animals slaughtered between the weights of 600 and 800 lbs. had stored 24.4 per cent of the protein, and that animals slaughtered between the weights of 900 and 1,500 lbs. had stored 20.4 per cent.

The author formulates a feeding standard on the basis of the data furnished by the animals. In this there is an allowance for maintenance of 0.4 lb. of crude protein per 100 lbs. of protein in the body and an allowance for production (except at the early stages when milk is fed) of 1.75 lbs. of crude protein for each pound of protein that is expected to be stored in the body. The total nutrients required are determined from the protein requirements by assuming the gradual widening of the nutritive ratio up to a weight of 900 lbs. For this and heavier weights the nutritive ratio is 1:10.

Biochemical changes in the flesh of beef animals during underfeeding, C. R. Moulton (*Jour. Biol. Chem., 43 (1920), No. 1, pp. 67–78, fig. 1*).—The author reports data on the chemical composition of the flesh of 7 steers, 6 of which had been slaughtered after a period of experimental feeding, the other being used to determine the initial composition. One of the animals was given a full feed and was very fat when slaughtered, one was so fed as to gain about a half a pound a day, two were kept at approximate body maintenance, and two were so fed as to lose about a half a pound a day. Details of the experiment and a large amount of data on the composition of the bodies of the steers were reported in Missouri Station Research Bulletin 28 (E. S. R., 40, p. 567). In the present paper the data are computed on the fat-free or protoplasmic basis used by C. W. Greene[1] in his study of the muscle tissue of salmon during the fast of the spawning migration. The author commends this method of computation and deplores the usual method of calculating to a water-free basis. The following table summarizes much of the data:

Chemical composition of the flesh of fat and thin steers.

Condition of steer.	Age at slaughter.	Fat content of flesh	Composition of fat-free flesh.				Nitrogen distribution.			
			Water.	Nitrogen.	Ash.	Phosphorus.	Water-insoluble N.	Albumin N.	Albumose and peptone N.	Amino acid and extractive N.
	Months.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Fat[1]	11	18.50	76.42	3.585	1.045	0.205	82.06	8.17	3.43	6.33
Very fat	21	32.55	75.98	3.535	1.042	1.107	82.46	6.53	4.15	6.84
Fat	17	20.22	75.99	3.299	1.009	.201	82.87	6.69	4.00	6.42
Fairly fat	17	19.67	77.05	3.361	.993	.188	81.58	7.23	4.55	6.63
Thin	23	8.47	77.04	3.367	1.044	.203	82.92	7.78	2.73	6.56
Very thin	17	6.10	75.83	3.343	.946	.190	81.36	8.31	3.56	6.73
Extremely thin	23	1.87	77.04	3.180	1.054	.176	85.31	4.81	3.42	6.44

[1] Control steer, slaughtered to determine initial composition.

It is concluded that inanition or partial starvation does not cause a watery muscular tissue, that the fat is practically the only constituent resorbed, and that the character of the nitrogenous material is altered by the removal of some of the albumin nitrogen. In the liver of the starved animals there was a

[1] Jour. Biol. Chem., 39 (1919), No. 3, pp. 435–456.

high water and a high nitrogen content, but the glycogen was not depleted. The blood of the fasted steers contained more water and less nitrogen than the blood of normal steers, and the muscle fibers were greatly decreased in diameter and length.

Sheep, H. GIRARD and G. JANNIN (*Le Mouton. Paris: Libr. Agr. Maison Rustique, 1920, pp. XVI+333, pls. 20, figs. 34*).—This volume covers in considerable detail the breeding and feeding of sheep, with particular reference to conditions in France and in the French colonies.

The decline in sheep breeding, H. REW (*Jour. Min. Agr. [London], 27 (1920), No. 5, pp. 450–455*).—The author presents statistics showing the steady decline in sheep breeding in England since 1870. During the recent war the decline was associated with the increase in arable land, since governmental control of mutton prices made the selling of hay more profitable than feeding it to sheep.

Lambing ewes on feed, R. H. WILLIAMS (*Arizona Sta. Rpt. 1919, pp. 422, 423*).—In a 7 weeks' comparison of roughages for pregnant ewes, it was found that pea hay was too coarse and was not so satisfactory as alfalfa hay, and that silage alone, while it made the ewes fat, was not satisfactory for milk production.

Pork production, W. W. SMITH (*New York: Macmillan Co., 1920, pp. XIX+492, pls. 12, figs. 20*).—This volume is devoted mainly to problems of feeding and management, but there are also chapters on marketing and markets, judging, breeds of hogs, breeding, and the prevention of hog diseases, the last written by R. A. Craig. The volume is notable for its review and digest of experiment station feeding trials and its summary of recent developments in the use of forage crops, by-products feeds, and grains other than corn.

Fattening hogs on garbage v. rolled barley, R. H. WILLIAMS (*Arizona Sta. Rpt. 1919, pp. 424, 425*).—In an experiment lasting 4 weeks it was found that a lot of four 122-lb. hogs fed garbage from the university dining hall made a daily gain of 2.03 lbs. per head, while a comparable lot fed rolled barley (3.45 lbs. per 100 lbs. live weight) gained only 0.87 lb.

Cottonseed meal for horses, G. A. BELL and J. O. WILLIAMS (*U. S. Dept. Agr. Bul. 929 (1920), pp. 10*).—This is a report of an experiment to determine to what extent cottonseed meal may be fed to horses with safety. Four Morgans, used consistently for driving or riding, and 12 Percherons or Percheron grades, doing rather heavy farm work, were used, and the experiment continued from October, 1917, to August, 1918. In the beginning the ration consisted of timothy hay, oats (8 to 27 lbs. depending on the body weight), 3 lbs. of bran, and in the case of 9 individuals 0.25 lb. of cottonseed meal. Cottonseed meal was increased as the animals would consume more, and in some cases as much as 3 lbs. was given. It was difficult at first to get the animals to eat cottonseed meal, but later, with some individual exceptions, they relished it. It is concluded that 1 lb. per 1,000 lbs. live weight is the most satisfactory amount to feed. The feeding of cottonseed meal to brood mares had no ill effects on them or on their colts.

Twenty-three sample rations containing cottonseed meal are listed.

Raising colts, M. W. HARPER (*New York Cornell Sta. Bul. 403 (1921), pp. 5–49, figs. 17*).—This is a report of observations on the raising of colts begun in 1909 and covering the colt crop during 10 years. Records of 34 mares employed in farm work with some hauling of coal are included.

Out of 144 matings of these mares there were 83 live colts born, including one pair of twins, and of these 17 colts died soon after birth. The gestation period varied from 316 to 361 days, the average being 333 days. The gestation period of male foals averaged about 4 days longer than that of female foals.

In another group of 171 mares it is noted that the gestation period averaged 335 days and that the difference between the sexes was not so marked.

Winter feeding statistics (October 9 to May 8) are given for 66 weanlings, 53 yearlings, and 46 two-year-old colts. The weanlings consumed an average of 1,214 lbs. of grain and 1,594 lbs. of hay, or 4.8 lbs. of grain and 6.3 lbs. of hay per pound of gain; the yearlings averaged 1,507 lbs. of grain and 2,525 lbs. of hay, or 8.7 lbs. of grain and 14.6 lbs. of hay per pound of gain; the two-year-olds averaged 1,898 lbs. of grain and 2,790 lbs. of hay, or 25.6 lbs. of grain and 37.7 lbs. of hay per pound of gain. If a suckling is charged with 180 lbs. of grain it appears that the total feed consumption of a colt from birth until the age of 3 years is approximately 2.4 tons of grain and 3.4 tons of hay.

An estimate of the cost of raising a colt to 3 years is given, and it is concluded that colts could be sold at a profit of about 30 per cent on the investment in feed and miscellaneous expenses.

Much general advice on the feeding and management of brood mares and colts is included.

Factors in incubation, II, G. H. Lamson, jr. and L. E. Card (*Connecticut Storrs Sta. Bul. 105* (*1920*), *pp. 5–35*).—This is primarily a study of the individuality of the hen with regard to fertility and hatching quality of her eggs, and is a continuation of observations on other factors involved in hatching reported in Bulletin 95 (E. S. R., 39, p. 481). The data were collected during the hatching seasons of 1917 and 1918 from trap-nested White Leghorn hens.

It was found that the infertile eggs in a flock were laid by a relatively few hens, which were rather consistently infertile. Somewhat similar results were secured when the hatching percentages were considered, for the coefficients of correlation between the season's hatching percentage of hens and the hatching percentages of the eggs of the same hens at the successive hatches were in all cases positive, significant, and fairly large. The correlation between the season hatching percentage and the first hatch was 0.48 and between the season's total and the second hatch 0.76 (the highest observed). It is concluded, therefore, that the season's hatching percentage of a flock could be considerably increased by discarding eggs from hens giving a low hatching percentage during the early hatches of the season. There was no evidence of significant correlation between egg production and fertility or egg production and hatching quality.

Final report of First Western Washington Egg-laying Contest, Mr. and Mrs. G. R. Shoup (*Washington Sta., West Wash. Sta. Mo. Bul., 8* (*1920*), *No. 9, pp. 134–138*).—This is a report of the 1919–20 egg-laying contest and includes a summary of the feed consumed by the average bird in the American and Mediterranean classes and the total egg record of each of the 42 pens (5 birds each).

Economic position of the poultry industry, E. Brown (*Jour. Min. Agr.* [*London*], *27* (*1920*), *No. 5, pp. 458–462*).—The author reviews the changes in egg and poultry prices in Great Britain from 1913 to 1919, and compares the 1913 and 1919 importations of eggs and dressed poultry. It is thought that the normal trade in Egyptian eggs will soon be resumed, and that Canada but not the United States will continue to export large quantities of eggs to Great Britain.

Comparative investigations on domestic and wild ducks, O. Timmann (*Zool. Jahrb., Abt. Allg. Zool. u. Physiol. Tiere, 36* (*1919*), *No. 4, pp. 621–656*).—The author reports an elaborate comparative study of the body weights and the weights and measurements of the internal organs, brain, skeletal parts, and muscular systems of wild and domesticated ducks, the main purpose being to study the influence of domestication on the body parts.

Feeding rabbits, F. W. Arms (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 9, pp. 142–144*).—A continuation of feeding experiments previously noted (E. S. R., 43, p. 676) is reported, 6 lots totaling 58 weanling rabbits (New Zealand Reds and Flemish Giants) being used in trials lasting 42 days. It was found (1) that long alfalfa hay was quite as satisfactory as chopped hay and definitely superior to alfalfa meal as a roughage, and (2) that a grain mixture of whole oats and rolled barley, 1:1, gave as good results as the mash of alfalfa meal, dried beet pulp, ground oats, ground corn, and mill run bran, 1:2:3:3:3, which has been a standard part of the ration at the station rabbitry for some time.

Indian trade enquiry.—Reports on hides and skins, C. C. McLeod, W. R. Dunstan, et al. (*London: Imp. Inst., 1920, pp. IX+123*).—This is a report on the trade in cowhides, buffalo hides, goatskins, and sheepskins in India, with suggestions toward the improvement of the quality of Indian hides, and notes on prospective markets for the raw hides in Canada, South Africa, and Australia.

DAIRY FARMING—DAIRYING.

Dairy cattle feeding experiment, W. S. Cunningham (*Arizona Sta. Rpt. 1919, pp 433–436*).—Three lots of 3 cows each were fed by the reversal method during three 28-day periods on the following rations: (1) Alfalfa hay 22 lbs., silage 45 lbs.; (2) alfalfa hay 30 lbs., cottonseed meal 4 lbs.; and (3) alfalfa hay 15 lbs., silage 45 lbs., and cottonseed meal 4 lbs. As in a previous experiment of the same type (E. S. R., 43, p. 777) ration 2 produced the most milk, but on this occasion ration 1 produced slightly more butter fat than ration 2.

[Influence on butter fat of the rice polish in the feed of dairy cows], A. R. Padmanabha Iyer (*Cent. Provs. and Berar Dept. Agr. [India], Rpt. Agr. Col., Nagpur, Bot. and Chem. Research, [etc.], 1919, p. 20*).—This is a brief report without experimental details of a study of the use of rice polish ("rice konda") with a ration of linseed cake and chuni for milch cows. Neither the milk yield nor the fat percentage was changed by the feeding of rice polish, but the saponification, Reichert-Meissl, and Polenske numbers of the butter fat were increased and the iodin number was decreased. It is concluded that rice polish counteracts the softening effect of linseed cake and thereby permits the production of a good quality of ghee in districts where cottonseed cake is not available.

Report of the Departmental Committee on the decline of dairying in Ireland, B. H. Barton et al. (*Dublin: Dept. Agr. and Tech. Instr., Ireland, 1920, pp. 31*).—This is a survey of the status of the dairy industry in Ireland made during the winter of 1919-20. The committee found that there had been no marked decline in the amount of milk available for human consumption, but that difficulties in distribution had prevented some towns receiving a normal supply. The governmental control of butter prices during the war caused an increase in cheese making, and the high price of beef induced some farmers to abandon dairying and take up beef raising.

Cost of milk production formula, F. T. Riddell (*Michigan Sta. Quart. Bul., 3 (1920), No. 2, pp. 45, 46*).—From studies of the cost of milk production on 225 farms (3,370 cows) in 9 Michigan counties, it was found that the following average amounts of feed and labor were required to produce 100 lbs. of milk: Home-grown grains 11 lbs., purchased feed 15.6 lbs., hay 31.1 lbs., other dry roughage 15.9 lbs., corn silage 114.5 lbs., other succulent feed 7 lbs., bedding 12.8 lbs., pasture 0.3 week, human labor 2.23 hours, and horse labor 0.1 hour. The other costs totaled 24.77 per cent of the combined feed and labor

costs. No mention is made of credits and a managerial charge is not included. These data are based on the costs throughout the year, and a sliding scale is presented in which the cost during each month is expressed as a percentage of the yearly cost.

Kingston milk distribution costs, E. H. PORTER (*N. Y. State Dept. Farms and Markets, Foods and Markets, 3 (1920), No. 27, pp. 13–26*).—This is the report of an investigation of the distribution of milk in Kingston, N. Y., made during the summer of 1920 by the State commissioner of foods and markets.

About 6,000 qts. a day are delivered by the 19 dealers in the city. The milk comes from 88 producers, many of whom ship only 1 can a day except in flush periods. Tabulated data include prices received by producers and distributors, the investment of distributors in plant, equipment, and supplies, and the individual items in the daily cost of handling milk by 13 of the distributors. It is concluded that a great reduction in the abnormally high distribution cost (due in great part to the large amount of capital invested per unit of milk distributed) would result from the use of a single plant for collecting, cooling, and bottling the milk. The local requirements that milk from each producer be bottled separately and that no unbottled milk be sold are considered unnecessary additions to the distributing costs.

Report of the fair price milk committee of the City of New York, R. S. COPELAND ET AL. (*N. Y. State Leg. Doc. No. 29 (1920), pp. 5–64, pls. 3; abr. in Creamery and Milk Plant Mo., 9 (1920), Nos. 3, pp. 26–30; 4, pp. 34–38*).—This is a report of a committee appointed by the governor to study the process of distributing milk in New York City and to consider the possibility of reducing the cost of distribution by improving the methods.

Among the methods of reducing the costs recommended by the committee are the collective hauling of milk from farms to shipping stations, better location of country stations with regard to transportation facilities and territory drawn from, the consolidation of city milk plants, a zoning system for retail delivery, and the increased selling of milk through grocery stores. To increase the supply of milk for the city the committee advocates legal restrictions in the use for manufacturing purposes of milk produced within a 150- or 200-mile radius. Court decisions are also cited to show that the legislature has the right to regulate milk prices.

Cost of market milk production in Detroit area, F. T. RIDDELL (*Michigan Sta. Quart. Bul. 3 (1920), No. 2, pp. 43–45*).—This is a statement of the cost per cow of producing milk in Macomb County during the year ended September 30, 1919, and in Wayne and Monroe Counties during the year ended April 30, 1920. A study of the winter cost in Macomb County has been noted (E. S. R., 42, p. 377). The amounts of feed, bedding, and labor required per cow throughout the year are also included.

Labor used in bottling milk (*U. S. Dept. Agr., Bur. Anim. Indus., Milk-Plant Letter 81 (1920), pp 2; also in N. Y. Prod. Rev. and Amer. Creamery, 51 (1921), No. 10, p. 444; Creamery and Milk Plant Mo., 10 (1921), No. 1, p. 48*).—Data collected from city milk plants as to the amount of labor used in the machine filling and capping of milk bottles are tabulated. An average of 700.7 bottles were filled per man-hour in the 31 plants where machines of the rotary type were employed, and 763.4 bottles per man-hour in the 4 plants where the machines were of the type in which bottles are removed from the cases and passed through the filler and capper in rows. In some plants a great saving of labor was made by special systems of transferring bottles from the washers and feeding them to the fillers.

Labor used in washing bottles (*U. S. Dept. Agr., Bur. Anim. Indus., Milk-Plant Letter 83 (1921), pp. 2; also in Creamery and Milk Plant Mo., 10 (1921),*

No. 2, pp. 39, 40; Milk Dealer, 10 (1921), No. 5, pp. 66, 67).—Statistics collected at 109 city milk plants in the United States are summarized and discussed. To wash 1,000 bottles required one man-hour in the 56 plants where one automatic washer was installed, and three man-hours in the 49 plants where the ordinary turbine brush washers were used. Considerably more bottles were washed per hour in the former group. Inconvenient arrangement of the plant and excessive handling of the bottles decreased the efficiency whatever the type of bottle washer used. It is thought that all plants washing more than 5,000 bottles per day should install an automatic machine.

Detection of abnormal milk resulting from disturbances of secretion, G. KOESTLER (*Milchw. Zentbl., 49 (1920), Nos. 16, pp. 217–222; 17, pp. 229–236).*—The author examines the various methods that have been proposed for detecting milk from pathological udders, and concludes that chemical methods are more satisfactory than bacteriological ones. In particular the ratio of chlorids to sugar is considered the most useful indication of abnormal milk, but the ratio of chlorids to phosphates is nearly as satisfactory and easier to determine.

Milk-powder agar for the determination of bacteria in milk, S. H. AYERS and C. S. MUDGE (*Jour. Bact., 5 (1920), No. 6, pp. 565–586).*—The authors, working in the laboratories of the Dairy Division, U. S. Department of Agriculture, present formulas for three agar media containing skim milk powder. Two of these contain peptone and meat extracts in different proportions, and a third contains yeast extract in place of peptone or meat extract. The use of yeast extract is considered advantageous in cases where the composition of the peptone and meat extracts is known to influence the bacterial count.

The skim milk powder media were found to give much higher counts than standard extract agar, and the colonies were also much larger. The higher counts are held to represent more accurately the number of bacteria in milk, and the large size of the colonies makes the counting process more accurate. It was also found possible to count the colonies of strong and weak acid-producing bacteria, the alkali formers, inert bacteria, and peptonizing bacteria.

The use of washed agar in culture media, S. H. AYERS, C. S. MUDGE, and P. RUPP (*Jour. Bact., 5 (1920), No. 6, pp. 589–596).*—In connection with the work noted above, the authors have found that when washed agar is used with the standard peptone extract medium a higher count from milk was obtained in many cases than with the unwashed agar. Washing the agar reduced its content of calcium and magnesium salts, and experiments indicated that these salts inhibited the growth of certain organisms.

Biochemical studies on certain molds of the genus Penicillium important in cheese making, J. DVOŘÁK (*Rozpravy České Akad. Císaře Frant. Josefa pro Vědy, Slovesnost a Umění, Class II, 26 (1917), No. 31; abs. in Chem. Zentbl., 1920, I, No. 14, p. 509).*—Three species of molds, *P. roqueforti*, *P. album*, and *P. candidum*, were cultivated either in sterilized milk or in nutrient solutions having the same mineral constituents as milk.

When casein alone was added to the inorganic solutions it was strongly peptonized by the molds with the evolution of ammonia, and when both casein and lactose were added unstable acids were formed. With the addition of casein and lactic acid to the medium a small amount of acid was developed and considerable amounts of ammonia. When lactic acid bacteria were grown in the casein-lactose cultures of the molds there was a marked decomposition of casein but only a little acid production, while *P. roqueforti* cultures gave off the typical odor of Roquefort cheese.

Cultures in sterilized milk behaved like those in the casein-lactose medium, but with the production of the characteristic aroma in the case of *P. roqueforti*. Mixed cultures of *P. album* and *P. candidum* in the presence of lactic acid bac-

teria produced the changes in casein which occur in the ripening of Camembert, Brie, and Neufchâtel cheese. In the presence of lactic acid bacteria *P. roqueforti* produced the changes corresponding to the ripening of Roquefort cheese without the assistance of other molds, and in the absence of bacteria it retained the capacity of splitting the milk fats into fatty acids with the production of the typical aroma. These observations on *P. roqueforti* are considered contrary to some of the results of Jensen (E. S. R., 16, p. 705), who ascribed the aroma production to a symbiosis between *P. roqueforti* and *Oïdium lactis*.

Some of the factors influencing the growth of the molds were also studied. In a 3 per cent casein suspension the optimum concentration of lactic acid for the growth of *P. candidum* was 0.5 per cent, and growth ceased in a 4.5 per cent solution. In the case of *P. album* the optimum concentration was 1 per cent, and growth ceased at 4 per cent. *P. roqueforti* grew best in a 2 per cent lactic acid solution, but did not cease growing until the concentration reached 7.5 per cent. The presence of lactic acid bacteria reduced the assimilation of protein markedly, but increased the fat and ash content of the mycelia.

Proportioning the ingredients for ice cream and other frozen products (the balance method), O. E. WILLIAMS (*Jour. Dairy Sci., 3 (1920), No. 6, pp. 439–451; also in Creamery and Milk Plant Mo., 10 (1921), No. 2, pp. 54, 56, 58–60, 62*).—The author outlines a scheme of systematic computation for determining the amounts of various ingredients required for a mix of given volume and composition, having regard to the materials available.

VETERINARY MEDICINE.

Textbook of microbiology, edited by E. FRIEDBERGER and R. PFEIFFER (*Lehrbuch der Mikrobiologie. Jena: Gustav Fischer, 1919, vols. 1, pp. XIII+418, pls. 3, figs. 162; 2, pp. XI+419–1206, pls. 4, figs. 220*).—This extensive work, the various sections of which have been written by different contributors, consists of two volumes, the first dealing with the general phases of microbiology and the second with special diseases. The various sections and contributing authors are as follows:

Volume 1, history of epidemiological investigations, by K. Kisskalt; classification of pathogenic organisms, and general morphology and biology of bacteria, by H. Reichenbach; general morphology and biology of molds and yeasts, and diseases caused by them, by O. Bail; general morphology and physiology of the protozoa, by M. Hartmann; infection and immunity, by R. Pfeiffer; experimental chemotherapy, by P. Ehrlich; general epidemiology and prophylaxis, by M. Hahn; disinfection, by W. Prausnitz; legislation, by K. Kisskalt; methods, by R. Scheller; and bacteria in air, water, soils, and milk, by H. Reichenbach.

Volume 2, anthrax, by M. Neisser; tuberculosis, by H. Kossel; leprosy, by E. Gotschlich; epidemic cholera, by E. Freidberger; typhoid fever, paratyphoid, and infectious meat poisoning organisms, by P. Uhlenhuth; dysentery bacilli, intestinal bacilli in general, and colon bacilli, by W. Kruse; pathogenic cocci, by M. Ficker; influenza and the group of hemoglobinophilous bacteria, by R. Pfeiffer; bacilli of the Friedländer group, bacillus pyocyaneous, and pest, by M. Neisser; diphtheria, by R. Scheller; glanders, tetanus, milignant edema, and blackleg, by P. H. Römer; gas gangrene, R. Pfeiffer; botulism, P. H. Römer; hemorrhagic septicemia of animals, swine erysipelas, pseudotuberculosis, organisms of the paratyphoid group pathogenic for animals, actinomycosis, and Madura foot, by W. Pfeiler; spirochetes, by E. Gotschlich; pathogenic protozoa, by C. Schilling; typhus fever, by E. Gotschlich; filterable viruses, F. Loeffler; and malignant tumors, by E. v. Dungern.

Human parasitology with notes on bacteriology, mycology, laboratory diagnosis, hematology, and serology, D. RIVAS (*Philadelphia and London: W. B. Saunders Co., 1920, pp. 715, pls. 8, figs. 523*).—In this work the protozoa are dealt with in part 2 (pp. 49–225), the metazoa in part 3 (pp. 227–576), and vegetable parasites in part 4 (pp. 577–622).

J. Buch's practicum of pathological anatomy for veterinarians and students, B. SCHUBERT (*J. Buch's Praktikum der pathologischen Anatomie für Tierärzte und Studierende. Berlin: Richard Schoetz, 1919, 5. ed., enl., pp. V+150, figs. 2*).—This is the fifth enlarged edition of the work.

The essentials of histology, E. A. S. SCHAFER (*London: Longmans, Green & Co., 1920, 11. ed., pp. XII+577, figs. 720*).—This is a new edition of a textbook first published in 1885.

Special pathology and therapy of the domestic animals, F. VON HUTYRA and J. MAREK (*Spezielle Pathologie und Therapie der Haustiere. Jena: Gustav Fischer, 1920, 5. ed., rev. and enl., vols. 1, pp. XVI+1256, pls. 14, figs. 257; 2, pp. XIV+1216, pls. 7, figs. 236*).—This is the fifth revised and enlarged edition of this work, of which the fourth German (E. S. R., 32, p. 371) and the second English translation from the fourth German edition (E. S. R., 36, p. 477) have been noted

Laws and revised regulations governing the suppression and eradication of infectious and contagious diseases affecting live stock in the State of Georgia, P. F. BAHNSEN (*Ga. State Vet. Bul. 14, Ser. C, rev. ed. (1920), pp. 43*).—The laws and regulations are here brought together.

Annual reports on the distribution of animal diseases in the German Empire (*Jahresber. Verbr. Tierseuch. Deut. Reiche, 27 (1912), pp. VI+120+254, pls. 4; 28 (1913), pp. IV+73+156, pl. 1; 29 (1914), pp. IV+55+143*).—These are the usual detailed reports on the occurrence of infectious diseases of domestic animals in Germany (E. S. R., 28, p. 583).

The organization and function of the veterinary service in Egypt, J.-B. PIOT (*Mém. Inst. Égypte, 2 (1920), pp. III+99, pls. 2*).—Part two of this report deals with the occurrence of and work with infectious diseases of live stock in Egypt.

Eleventh report of the Institute for Infectious Animal Diseases (*Tokyo Inst. Infectious Anim. Diseases Rpt. 11 (1920), pp. 38+[41], pls. 6*).—The occurrence of and work with animal diseases in Japan is here reported upon under the headings of statistics of scheduled animal diseases, 1910-1919; outbreaks of scheduled animal diseases in the different months during 1919; districts in which outbreaks of scheduled animal diseases occurred during the last five years; results of examinations for bovine tuberculosis in 1918; preparation and distribution of sera, vaccines, and biological diagnostica; and vaccination and serum injection.

Maps showing the areas in the country where outbreaks of scheduled animal diseases occurred in 1919, which are attached, relate to anthrax, blackleg, bovine lymphangitis, hog cholera, swine erysipelas, and rabies.

The preparation of a culture medium suitable for the growth of organisms used as vaccines, D. NORRIS (*Indian Jour. Med. Research, 7 (1920), No. 3, pp. 536–544*).—Continuing the investigation previously noted (E. S. R., 41, p. 680), a method of preparing a culture medium from caseinogen by hydrolysis with pancreatic extract is described, and the results obtained with it in the growth of various pathogenic organisms are compared with those obtained with the use of a meat medium. The method is said to be simpler, quicker, and cheaper than similar methods employing meat and the resulting medium to yield equally good growths of bacteria.

The laws of activation through dilution and decomposition, an extension of vaccine therapy, H. MUCH (*München. Med. Wchnschr., 67 (1920), No. 35, pp. 1005, 1006*).—This is a brief discussion of the principles involved in the activation of vaccines through dilution and through decomposition (partial antigens).

Bacterial vaccines.—Chloretone solution as a vehicle for their administration, R. G. OWEN, F. A. MARTIN, and W. L. BROSIUS (*Jour. Lab. and Clin. Med., 6 (1920), No. 1, p. 47*).—The authors suggest the use of a saturated solution of chloretone for washing bacterial suspensions from agar slants and diluting the suspensions. After the desired dilution is made the vaccine is heated in a water bath at from 50 to 60° C. for one hour. It is stated that there is no clumping of the organisms as is the case when tricresol or phenol is used, and that the resulting vaccine is perfectly homogeneous and sterile.

Abortion disease in cattle, L. P. BEECHY (*Ohio State Univ. Bul., 16 (1920–21), No. 1, pp. 31, figs. 4*).—A practical discussion of the disease and means for its control.

Report of committee on abortion of the American Veterinary Medical Association (*Michigan Sta. Quart. Bul., 3 (1920), No. 2, pp. 65, 66; also in Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 225, 226*).—This report consists of a summary of the present knowledge concerning infectious abortion of cattle.

The bleeding of cattle and swine for the blood tests of infectious abortion, I. F. HUDDLESON (*Michigan Sta. Quart. Bul., 3 (1920), No. 2, pp. 62–65, figs. 2*).—For the benefit of farmers and veterinarians brief directions are given for bleeding cattle and swine for agglutination and complement fixation tests for infectious abortion.

A study of the action of eight strains of Bacterium abortivo-equinus on certain of the carbohydrates, C. P. FITCH and W. A. BILLINGS (*Jour. Bact., 5 (1920), No. 5, pp. 469–476, fig. 1*).—In view of the conflicting results obtained by various workers in studies of the action of carbohydrates on different strains of *B. abortivo-equinus*, a detailed study was made at the Minnesota Experiment Station of the action of eight strains of this organism on a number of carbohydrates. From the data thus obtained the following conclusions were drawn:

"*B. abortivo-equinus* does not form gas in lactose or sucrose. The apparent fermentations of these carbohydrates are often the result of hydrolysis in the sterilizing process. *B. abortivo-equinus* does not ferment raffinose. Rhamnose is fermented with gas.

"A gradually progressive acidity up to 30 days is produced by nearly all strains of *B. abortivo-equinus* in carbohydrate media where considerable gas is formed. In carbohydrate broth in which no gas is formed a progressive alkalinity is formed over a 30-day period.

"In dulcitol media *B. abortivo-equinus* shows considerable variation in acidity and alkalinity. This variation is found in unheated as well as heated media."

Anthrax, W. E. KING (*North Amer. Vet., 1 (1920), No. 5, pp. 253–237*).—A brief review and discussion of recent literature which has been noted from the original sources.

Preventive action against anthrax in Morocco, T. MONOD and H. VELU (*Bul. Soc. Path. Exot., 13 (1920), No. 1, pp. 14–16*).—The authors state that in Morocco immunization against anthrax by the Pasteur method has given satisfactory results with sheep, hogs, and cattle, but that the immunity lasts only 8 or 10 months. It is recommended that the vaccination be renewed at least twice a year, either by giving a second injection of the second vaccine in a double dose or by the injection of a culture only slightly attenuated.

The control of blackleg, J. F. SHIGLEY and W. N. CHRISTOPHER (*North Amer. Vet., 1 (1920), No. 7, pp. 330–332*).—To determine the relative value of certain lots of blackleg aggressin, filtrate, and vaccine (attenuated virus) as protective agents against blackleg, 3 groups of 5 calves each were injected with 2 gm. of virus, 5 cc. of filtrate or aggressin, or 1, 2, or 3 virus pills. A group of 5 controls received virus alone. In this series the percentages of death from blackleg were as follows: Controls 100 per cent, filtrate 80, vaccine 60, and aggressin 40. In another series of experiments more nearly simulating field conditions in that only 0.75 gm. of virus was given, no losses occurred in the vaccinated calves, while the controls all died.

These results are interpreted as indicating the superiority of blackleg aggressin over the filtrate or attenuated virus vaccine, while at the same time showing that under ordinary field conditions any of the three products tested would be of sufficient protection against subsequent exposure to blackleg.

Serotherapy in a chronic myotic affection (epizootic lymphangitis), L. NÈGRE and A. BOQUET (*Rev. Gén. Méd. Vét., 29 (1920), No. 345–346, pp. 477–483*).—By applying the technique employed by Borrel (E. S. R., 15, p. 86) in the preparation of antisheep-pox serum, the authors hyperimmunized a horse recently recovered from ulcerous lymphangitis by successive injections of increasing doses of killed, followed by living, cryptococcic organisms. Subcutaneous injections of massive doses (25 to 40 cc.) of the serum thus obtained, at intervals of from 24 to 48 hours, in animals affected with epizootic lymphangitis caused a slight amelioration of the disease during the first days of the treatment, followed, however, by a rapid aggravation of the disease with the appearnce of new ulcers and an increase in suppuration. The intravenous injection of the same serum in weak but increasing doses influenced not only phagocytosis but the intracellular digestion of the parasites, provided a medium unfavorable for their multiplication, and brought about a rapid cure.

Vaccination against foot-and-mouth disease, BELIN (*Jour. Soc. Natl. Agr. Belg., 2 (1920), No. 50, pp. 441, 442*).—The author reports the successful use of a vaccine for foot-and-mouth disease, both as a preventive and curative measure.

The deviation of complement in the diagnosis of glanders with hemolytic antihorse alexin, G. FINZI (*Rev. Gén. Méd. Vét., 29 (1920), No. 345–346, pp. 473–477*).—The author is of the opinion that failures in the complement deviation test for glanders are often due to the complexity of the materials required to perform the test. In proof of this a simplified method is described, with which, in a number of trials to be reported elsewhere, it is claimed that the reaction is uniformly positive with the serum of glandered animals and negative with that from normal animals. The materials employed consisted of the antigen (Pasteur or Sclavo mallein diluted to one-fifth in physiological solution), the inactivated but not diluted serum of the horse to be examined, hemolytic antihorse alexin serum diluted to one-fourth in physiological solution, and well-washed red globules (horse) in 10 per cent solution. The hemolytic antihorse serum is obtained by injecting medium weight rabbits with horse cells washed in about 20 volumes of physiological solution. Five injections are made at intervals of five days, the first consisting of 1 cc., increased by 1 cc. for each injection.

Hemorrhagic septicemia, W. W. DIMOCK (*North Amer. Vet., 1 (1920), Nos. 6, pp. 292–296; 7, pp. 349–352*).—The author discusses hemorrhagic septicemia from the standpoint of etiology, mode of infection, period of incubation, symptoms, morbid anatomy, diagnosis, and vaccination.

In an attempt to determine the mode of infection, swine were inoculated with virulent cultures of *Bacillus suisepticus* by intratracheal, intramuscular, subcutaneous, and intravenous injections, and by administration per os. The results obtained were not conclusive, the intravenous method alone furnishing consistently positive results.

In the opinion of the author, the first problem involved in a more definite understanding of the disease is to determine the mode of infection, including the predisposing factors, and to develop a reliable and effective vaccine. "Granting that hemorrhagic septicemia is in a very great majority of cases secondary to other diseases, the fact that many of these diseases are not in themselves fatal, the losses being from the result of a double infection, still causes us to hold out the hope that if we can immunize our animals against hemorrhagic septicemia the death rate from other infectious diseases, excluding hog cholera and infectious diarrhea, may be reduced to a minimum."

Hemorrhagic septicemia, vaccine or bacterin treatment, W. E. King (*North Amer. Vet., 1 (1920), No. 7, pp. 340–342*).—A review of recent literature on the subject, with a criticism of the conclusions drawn by Van Es and Martin previously noted (E. S. R., 43, pp. 882, 887).

Notes on the detection of Bacillus tetani, G. W. McCoy and I. A. Bengtson (*Pub. Health Serv. U. S., Hyg. Lab. Bul., 115 (1918), pp. 7–37*).—The observations reported, which were made in connection with the examination of suspected material involved in a number of cases of tetanus following vaccination against smallpox, furnish considerable information in regard to the effect of different factors on the growth of tetanus spores and the best means of detecting *B. tetani* contamination. It was found possible to detect a much smaller amount of such contamination, both alone and in vaccine virus, by cultural methods and animal inoculation from the cultures than by direct animal tests.

Trypanosomiases of animals in Venezuela, E. Tejera (*Bul. Soc. Path. Exot., 13 (1920), No. 4, pp. 297–305*).—The first part of this paper deals with trypanosomiasis of equines due to *Trypanosoma venezuelense*, which occurs throughout nearly all of Venezuela, and the second part with trypanosomiasis of bovines due to *T. guyanense*, which is thought to be a variety of *T. cazalboui*, or even *T. cazalbani*, which may have been introduced in zebus. The equine disease appears in two clinical forms, one of which is known as peste boba, hermosura, and tristeza, the mortality in which is 80 per cent, the other as desrengadera, in which the mortality is nearly 100 per cent.

The epidemiology of tuberculosis, H. von Hayek (*Ztschr. Tuberkulose, 32 (1920), No. 4, pp. 219–228*).—A theoretical discussion.

A note on the effect of amino acids on the growth of tubercle bacilli, P. Masucci (*Jour. Lab. and Clin. Med., 6 (1920), No. 2, pp. 96–98, fig. 1*).—By using in place of the 2 per cent Difco peptone employed in the standard method of preparing glycerin bouillon for the growth of tubercle bacilli, 1.7 per cent of Difco peptone +0.3 per cent Aminoids, a commercial preparation of amino acids, much better growth of the bacilli took place than with the ordinary medium. Analyses of the two media showed that the modified medium contained 31 per cent more amino acids and 50 per cent more phosphorus than the ordinary glycerin peptone bouillon.

The spread of tuberculosis among cattle, W. Seifert (*Ztschr. Tuberkulose, 32 (1920), No. 4, pp. 206–218*).—Statistics covering a period of nearly 30 years are given of the extent of bovine tuberculosis in Germany, Austria, Hungary, Denmark, Norway, Sweden, Switzerland, and Holland. The data are obtained from meat-inspection reports and tuberculin tests.

Has the risk of tuberculosis infection of the bovine type increased during the war? F. Schaeffer (*Ztschr. Tuberkulose, 32 (1920), No. 4, pp. 193–

206).—The author is of the opinion that the marked increase in tuberculosis in Germany during the war can be traced indirectly to carelessness in observing the regulations for the use of milk from mixed or tuberculous herds.

Work on poison plants, J. J. Thornber (*Arizona Sta. Rpt. 1919, pp. 428–431*).—Work on poisonous range plants commenced the previous year was continued, the commoner poisonous plants in the southern and central parts of the State having been carefully studied both in the field and by means of plant collections. Data were collected relative to their poisonous properties, seasons of growth, flowering and fruiting, etc.

In eradication work, digging seemed to be the simplest means of dealing with the loco plants, which were invariably killed when cut off at the root from 2 to 4 in. below the crown. In combating loco plants it is only necessary to dig out the larger and more luxuriant growing plants, which are the ones from which stock eat enough to produce ill effects. The smaller and weaker plants will either die out during the year or else grow large enough the following year to be easily seen. No loco plant should be allowed to mature seed, and in order to prevent this ,cutting or digging should begin before or at the time the plants first begin to flower.

Mention is made of several plants received from different localities which are thought to cause stock poisoning. In the vicinity of Dewey, bledo or careless weed (*Amaranthus palmeri*), is said to have poisoned stock on several occasions. A brief account is also given of investigations of losses of stock on certain foothill ranges in southern Arizona in the vicinity of Douglas.

Poisoning of cattle by food, A.-L. Marchadier and A. Goujon (*Les Empoisonnements du Bétail par les Aliments. Paris: Libr. Agr. Maison Rustique, 1920, pp. 111+118, figs. 18*).—This is a small handbook in which are discussed (1) poisonous plants (pp. 9–34), (2) dangerous foods (pp. 35–98), and (3) well and stagnant waters (pp. 99–112).

Some methods of medicating dairy cattle, W. T. Johnson (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1920), No. 9, pp. 138–140, figs. 4*).—This is a description of the drench, capsule, and syringe methods of administering medicine to cattle.

Preliminary report on the use of autogenous bacterins in the treatment of sterility of cattle, O. Stader (*North Amer. Vet., 1 (1920), No. 5, pp. 241–244*).—The author describes the technique of obtaining material and preparing and administering autogenous bacterins for the treatment of sterility of cattle, and presents data obtained in the treatment of a number of cases with such bacterins. Of 12 cows whose history was followed after such treatment, a marked improvement in condition was noted in all cases at the end of two weeks, and conception occurred later in 7 cases. The failure completely to recover in some cases is attributed by the author to inability to obtain a representative specimen of uterine exudate.

The cattle tick sweeps onward in Australia and inflicts heavy losses (*Sci. and Indus.* [*Aust.*], *1 (1919), No. 3, pp. 139, 140, figs. 2*).—A map is given showing tick-infested areas of Australia, where the tick has spread, until now it has taken possession of the littoral from the Tweed Heads (N. S. Wales) to Wyndham (Western Australia), and penetrated hundreds of miles inland.

Control of fluke disease by destruction of the intermediate host, A. C. Chandler (*Jour. Agr. Research* [*U. S.*], *20 (1920), No. 3, pp. 193–208*).—This is a report of studies conducted at the Oregon Experiment Station and later continued at Houston, Tex., with a view to the discovery of some effective means for destroying fresh-water snails, which act as intermediate hosts of flukes. The importance of the liver fluke problem for sheep and cattle raisers in the Willamette Valley of Oregon led to the inauguration of the investigation.

An attempt was made to find a cheap chemical substance, readily soluble in water, which would be destructive to snails in relatively weak solutions and which would not render water either injurious or unpalatable for man or domestic animals. A number of different substances were tested, their effect upon *Limnæa (Galba) bulimoides* at different dilutions for periods of time from 1 to 24 hours being recorded. These tests demonstrated the fact that copper salts have an extremely toxic effect on snails, even in such great dilutions as 1 part to 1,000,000 parts of water. Mercuric bichlorid is the only other salt experimented with which approaches the salts of copper in its toxicity to snails.

Experiments with various copper salts were tried, and it was found that with equivalent concentrations of the Cu ion their toxicity was approximately the same. Copper sulphate, being the cheapest copper salt, was selected for further experiments, in which 10 snails of a species in 1 liter of the solution, at approximately 18 to 20° C., were used.

"In an experiment upon 8 species of 6 families it was demonstrated that copper sulphate in proportions of 1 part to from 500,000 to 2,000,000 parts of water destroys snails of all these species within 48 hours; 50 per cent or more are destroyed in dilutions up to 1 to 5,000,000. From the point of view of expense, harmlessness, and convenience in use copper sulphate is preferable to any other substance which has been tried or suggested for destroying snails. The eggs of the snails are not destroyed by the copper salts.

It is pointed out that water treated with copper sulphate is uninjured for drinking, bathing, or irrigation purposes. "The effectiveness of copper sulphate in water is modified more or less by temperature, alkalinity, dissolved organic matter, and living algæ. Some allowance should be made for these factors in estimating the amount of copper to be used in any given body of water. The proportion should vary from 1 to 1,000,000 in relatively pure water at 20° C. or above to 1 to 500.000 in water which is very cold, is alkaline, contains dissolved organic matter, or harbors an abundance of algæ. If the growth of algæ is very luxuriant, it would probably be advisable to kill these algæ by a preliminary treatment with a 1 to 1,000,000 solution of copper sulphate, following this in the course of a few days or a week by a second treatment. Copper sulphate can be administered to ponds, reservoirs, or other bodies of standing water in the way advised by Moore and Kellerman for the destruction of algæ in water" (E. S. R., 16, p. 238). For the treatment of running streams the use of a barrel of suitable size, fitted with a screened spigot, is recommended. In water which is not alkaline, large streams could be treated more easily by allowing the copper sulphate, in the form of uniform crystals, to dissolve directly into the stream through the screened end of a tube.

A list of 18 references to the literature is appended.

Parasites and parasitic diseases of sheep, M. C. HALL (*U. S. Dept. Agr., Farmers' Bul. 1150 (1920), pp. 53, figs. 34*).—This is a popular account of the important parasites and parasitic diseases of sheep, including preventive and remedial measures. Attention is called to the fact that most of the loss in sheep, mutton, and wool is from animal parasites, since sheep suffer comparatively little from bacterial and virus diseases.

Sheep diseases, E. T. BAKER (*Chicago: Amer. Vet. Pub. Co., 1920 [2. ed., rev. and enl.], pp. 299, pl. 1, figs. 122*).—This is a new and enlarged edition of the work previously noted (E. S. R., 36, p. 182).

An attempt at simultaneous vaccination of sheep against anthrax and sheep pox, C. DUBOIS (*Rev. Gén. Méd. Vét., 29 (1920), No. 345–346, pp. 483–486*).—Of six animals vaccinated simultaneously with anthrax and sheep-pox vaccine, all acquired sufficient immunity against sheep pox to resist the effects of natural

and experimental sheep-pox infection and all but one the effects of experimental anthrax infection. In the case of the anthrax infection, a control sheep vaccinated against anthrax alone succumbed to the disease following experimental infection, thus indicating the severity of the infection. The duration of immunity following this double inoculation has not yet been tested.

Septicemic infection in lambs caused by the bacillus of swine erysipelas, M. CHRISTIANSEN (*Maanedsskr. Dyrlæger, 31 (1919), No. 12, pp. 241-254; abs. in Jour. Compar. Path. and Ther., 33 (1920), No. 3, p. 212*).—This is a report of post mortem examination made of a lamb 38 hours old in a flock in which there had been a very high mortality among the lambs, revealing hemorrhagic enteritis, great enlargement of the mesenteric glands, degenerative changes in other organs, and small hemorrhages under the endocardium and epicardium. Small bacilli present in pure culture were found to represent the swine erysipelas bacillus. It is stated that no case of swine erysipelas in pigs had occurred at the farm during the time of the outbreak among the lambs.

Hog cholera, W. W. DIMOCK (*North Amer. Vet., 1 (1920), Nos. 4, pp. 193-198; 5, pp. 245-249*).—This is a discussion with illustrations from the author's practice of the etiology, symptoms, and lesions of hog cholera, and of important points to be observed in the technique of vaccination.

The founder of the horse, R. STRAUNARD (*La Fourbure du Cheval. Paris: Jouve & Co., 1919, pp. 218, pls. 14, figs. 29*).—The author deals with the anatomy and physiology of the foot of the horse, and the etiology, pathology, diagnosis, and treatment of founder.

Stallions cured (clinically) of dourine may continue to be carriers of pathogenic trypanosomes, E. SERGENT, A. DONATIEN, and A. LHÉRITIER (*Bul. Soc. Path. Exot., 13 (1920), No. 7, pp. 515-518*).—In investigations in Algeria, trypanosomes reappeared in the peripheral blood of three stallions at the end of 14 months, 2 years, and 3 years and 3 months, respectively. They were all animals which to every appearance had been entirely cured of dourine through the administration of atoxyl and orpiment, and whose blood was no longer infectious, even in doses of several liters. The infectivity tests of the blood extended over a period of 3 years. Thus it appears that a stallion once infected continues dangerous notwithstanding that clinically he has entirely recovered from the disease.

Strongylidæ in horses, IX-XIII, W. YORKE and J. W. S. MACFIE (*Ann. Trop. Med. and Parasitol., 14 (1920), No. 2, pp. 153-179, figs. 25*).—In continuation of this account (E. S. R., 41, p. 685), the papers presented relate, respectively, to *Cylicostomum tridentatum* n. sp., the genus Poteriostomum of Quiel, species found in West Africa and Jamaica, *Cylindropharynx rhodesiensis* n. sp., and *Cylicostomum triramosum* n. sp.

RURAL ENGINEERING.

Smithsonian physical tables, F. E. FOWLE (*Smithsn. Misc. Collect., 71 (1920), No. 1, pp. XLVI+450*).—This is the seventh revised edition of these tables. A large amount of data is included which is useful to engineers, and which does not usually appear in detail in engineering handbooks. Noteworthy instances of such data are the tables on the mechanical properties of metals and materials of construction, compressibility of gases, acoustics, aerodynamics, viscosity of fluids and solids, thermometry, latent heats and heats of combustion, radiation, cooling by radiation, conduction and convection, photometry, photography, refraction, reflection, transmissive powers, electromotive powers, electrical resistance, radioactivity, colloids, meteorology, and geodetics.

Engineering investigations: Program to be undertaken during the fiscal year 1921, J. L. SAVAGE (*Reclam. Rec.* [*U. S.*], *11* (*1920*), *No. 12, pp. 578, 579*).—The engineering experimental program for the U. S. Reclamation Service for the fiscal year 1921 is outlined. The experiments include especially projects on factors relating to the flow of water and the design of structures therefor.

Hardness of surface waters of the United States, W. D. COLLINS (*Jour. Indus. and Engin. Chem., 12* (*1920*), *No. 12, pp. 1181–1183*).—This paper gives a very general account of the hardness of surface waters in the United States. The drainage basins as used in the studies of stream flow made by the U. S. Geological Survey are taken up in order, and an estimate is given of the range of the average quantity of dissolved mineral matter and of hardness likely to be found in river and lake waters.

It is shown that soft surface water is found along the Atlantic, east Gulf of Mexico, and Pacific coasts and along the northern boundary States. Hard water is found in the Middle Western States bordering the Mississippi and to the east. Hard and strongly alkaline waters are found in the area outlined roughly by North Dakota, Arkansas, Louisiana, Texas, Arizona, and southern California.

The hydraulic jump and critical depth in the design of hydraulic structures, J. HINDS (*Engin. News-Rec., 85* (*1920*), *No. 22, pp. 1034–1040, figs. 9*).—This is a technical treatment of the subject, in which the application of established principles relating to hydraulic jump and critical depth to the design of canals and other works is described. A theoretical study based on the laws of conservation of energy and of linear momentum is included.

Cement plaster lining for wood irrigation flumes, E. N. BRYAN (*Engin. News-Rec., 85* (*1920*), *No. 23, pp. 1090–1092, fig. 1*).—Experiments on three flumes aggregating 1,560 ft. in length indicate that cement plaster lining may be successfully and more cheaply used for waterproofing than all-wood construction. The plaster used was composed of 1 part cement, 3 parts sand, and dry hydrated lime equivalent by weight to 10 per cent of the cement. The flumes were constructed with box siding and flooring of 1-in. No. 2 Oregon pine lumber, to which was applied a lining of plaster 1 in. in thickness. It was found that the annual maintenance cost was less than for a wooden box flume. No matter how long the water is out of the plaster-lined flume it may be safely turned back without extensive repairs.

Irrigation investigations, G. E. P. SMITH and W. E. CODE (*Arizona Sta. Rpt. 1919, pp. 447–455, fig. 1*).—This report includes, among other things, data on ground-water supply and stream flow in the Casa Grande Valley and on tests of cement pipe.

Tests of 8-in. pipe of 20 varieties that had been buried in a drain in alkaline soil for six years showed that there was no evidence of disintegration. There was a marked difference in the appearance of the fractured samples. The more porous tile appeared damp or wet and showed more or less alkali in the fracture, while the denser tile were dry and free from alkali. The densest and strongest tile were those which had been mixed with a quaking or wet consistency, and the opinion is expressed that drain tile for strongly alkaline soil should be mixed wet. Where tile had been dipped in or painted with cement grout, the grout was intact. A tar coating was less effective than the grout, and ferrous sulphate in the mixing water was found to be of no value.

The Tempe drainage ditch, A. E. VINSON, C. N. CATLIN, and S. W. GRIFFIN (*Arizona Sta. Rpt. 1919, pp. 409, 410*).—Continuing work previously noted (E. S. R., 43, p. 789), monthly analyses of the drainage waters from the Tempe drainage ditch for the year 1919 are reported. It is stated that while the com-

position varies considerably from month to month, the general tendency has been for the drainage water to become less saline.

Destroying stumps by the char-pitting method in Wahkiakum County, Wash., G. A. NELSON (*Wash. State Col. Ext. Dept., Ser. 1, [Pub.], No. 62 (1920), pp [4], figs. 3*).—This method is described as used in Wahkiakum County, Wash.

Modified TNT as a blasting explosive, C. E. MUNROE and S. P. HOWELL (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 30, pp. 27, 28*).—A review of work by others on the properties of a nitrostarch grenade powder is given, and experiments with a mixture of this powder with grade–III TNT are reported.

The review indicates that the grenade powder, while equivalent to ordinary dynamites, has marked hygroscopic properties, thus limiting its use to dry work. Sensitiveness tests of samples of the powder which had been packed and shipped, using No. 8 detonators, showed it to be too insensitive for use. Tests of mixtures of grenade powder and TNT, called modified TNT, showed that cartridges containing up to 50 per cent of powder were sufficiently sensitive. The mixtures were more easily packed in cartridge cases than TNT alone.

It is recommended that the modified TNT be packed in well paraffined paper cartridge cases and fired with the same detonator used for TNT. Owing to the tendency of modified TNT to absorb moisture, it is advised that the cartridges be used as promptly as feasible after receipt.

TNT a success in road work, L. E. SMITH (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 31, p. 13*).—Experience with TNT in road work is briefly reviewed, from which the conclusion is drawn that it is the best all-round explosive for this purpose and the safest to handle. It has been found specially useful and effective for blasting rock, and at prevailing prices for rock excavation has been found to effect an appreciable saving over ordinary drilling methods.

Superelevation and easement as applied to highway curves, A. L. LUEDKE and J. L. HARRISON (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 31, pp. 3–12, 18, figs. 7*).—An extensive analysis of the superelevation and easement of highway curves is given, together with a summary of data on practice in several States. Accomplishment of superelevation by revolving the pavement on the center line as an axis is said to be the method most commonly adopted.

The pitch of fully superelevated sections varies considerably. In Ohio the maximum rate of superelevation, which applies to all curves of 4° or sharper, is ½ in. to the foot. In New York a pitch of 1 in. to the foot is used where the radius is 300 ft. In Michigan the same pitch is used for a radius of 150 ft. or less. Practically all of the States vary the amount of superelevation as the radius of curvature varies. The New York practice furnishes complete superelevation for a speed of 20 miles per hour on curves of 300-ft. radius, and a complete superelevation for a speed of 30 miles per hour on curves having a 1,500-ft. radius. Speaking generally, the protection offered on curves whose radii lie between these limits is from 20 to 30 miles per hour.

In the matter of transition, State practice varies considerably. In Ohio the transition section is 100 ft. long without reference to the radius of the curve to which it is an approach. Other States generally follow a similar system. In New York State the length of the transition section is a function of the radius of curvature.

In general, the practice is to use a thickness on the superelevated sections equal to the edge thickness on the tangent plus one-half of the crown on tangents.

Data are also given on practice as to extra width of surface on curves and superelevation of reverse curves.

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Laying out circular curves by deflections from the P. I., T. F. HICKERSON (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 30, pp. 13–18, figs. 3*).—Mathematical formulas and tabular data are given for laying out circular curves by deflections from the point of intersection of the tangents.

Public Roads (*U. S. Dept. Agr., Public Roads, 3 (1920), Nos. 30, pp. 32, figs. 15; 31, pp. 28, figs. 14*).—These numbers of this periodical contain the usual project statements under Federal-aid allowances approved in September and October, 1920, respectively, and the following articles:

No. 30.—Eastern States Plan Their Snow Removal Work for Coming Winter, by J. L. Harrison; Laying Out Circular Curves by Deflections from the P. I., by T. F. Hickerson (see above); Belgian Traffic Census Report Issued after Long Delay by War; A New Concrete Road Film; Concrete Road Slabs Undamaged by Washout of Sandy Subgrade; 9,630 Miles of Marked Trails to be Built with Federal Aid; The Effect of Alkali upon Concrete, by S. H. McCrory; American Association of State Highway Officials to Meet at Washington; Outline of the Field to be Covered by Highway Research, by A. N. Johnson; and Modified TNT as a blasting explosive, by C. E. Munroe and S. P. Howell (see p. 385).

No. 31.—Superelevation and Easement as Applied to Highway Curves, by A. L. Luedke and J. L. Harrison (see p. 385); TNT a Success in Road Work, by L. E. Smith (see p. 385); The How and Why of Truck Impact, by E. B. Smith; and Design and Construction of Bridge Foundations, by L. N. Edwards.

The care of leather, F. P. VEITCH, H. P. HOLMAN, and R. W. FREY (*U. S. Dept. Agr., Farmers' Bul. 1183 (1920), pp. 18, figs. 13*).—This bulletin contains suggestions on the selection of articles made from leather, and tells how to care for them in order to obtain maximum service.

Particular reference is made to the drying, oiling, and waterproofing of boots and shoes and to the oiling and preservation of harness and driving belts. Brief information is also given on bookbinding, bag leather, and mildewing of leather.

The practice of lubrication, T. C. THOMSEN (*New York: McGraw-Hill Book Co., Inc., 1920, pp. XI+607, figs. 240*).—This is an engineering treatise on the origin, nature, and testing of lubricants and on their selection, application, and use. The author has endeavored to present for each type of engine or class of machinery a technical basis for lubrication. Considerable space is devoted to the lubrication of internal-combustion and steam engines, bearings, and other matters of interest from the farm machinery standpoint.

[Official gasoline and kerosene analyses, 1920], R. E. ROSE and E. T. CASLER (*Fla. Agr. Dept. Quart. Bul., 30 (1920), No. 4, pp. 99–120*).—Official analyses of 177 samples of gasoline and 58 samples of kerosene collected for inspection in Florida during the third quarter of 1920 are reported, together with deficiencies found.

Tractors in Connecticut, W. T. ACKERMAN (*Conn. Agr. Col. Ext. Bul. 25 (1920), pp. 16, fig. 1*).—Data are presented which were obtained from detailed reports from 45 Connecticut farms on which 59 tractors are operated.

It is estimated that the average life of a tractor in Connecticut is seven years. The tractor for field work is best adapted to seed-bed preparation. The most satisfactory results have been obtained on farms with each tractor caring for an average of 76.5 acres. The most popular and satisfactory horsepower rating varies from 8–16 to 12–22. The 3-plow tractor has given the best results. More than 82 per cent of the farms reporting used the tractor for belt work to good advantage. It has been found that the tractor to be successful should be used at least from 90 to 100 days per year. A total of 101 horses on 32 farms were displaced by tractors, averaging 3.3 per farm and 2.4 per tractor. Approxi-

mately 3½ gal. of gasoline or kerosene, 1 qt. of oil, and 5 cts. worth of hard grease were required to break an acre of ground.

Notes on the Lincoln tractor trials, 1920, T. CLOSE, B. J. OWEN, and H. G. RICHARDSON (*Jour. Min. Agr.* [*London*], *27* (*1920*), *No. 8, pp. 714–724*).—A general description of the second year of these tractor trials is given. In view of the results obtained, the competitive element of such trials as a desirable feature is considered questionable until design and construction have been placed on some definite standard basis.

Motor tractor trials at Turretfield experimental farm, A. J. PERKINS (*Jour. Dept. Agr. So. Aust.*, *24* (*1920*), *No. 2, pp. 121, 123–127, 129, 130*).—A plowing test lasting about a month on a South Australian experimental farm, comparing the work of two tractors with that of 10 horses, is reported.

One of the tractors was practically eliminated owing to break downs, but the other plowed the full month, drawing a 3-furrow plow cutting a strip 25.5 in. wide at depths of from 5 to 5.5 in. The 10-horse team pulled a 5-furrow plow cutting a strip averaging 5.5 in. in depth and 40 in. in width. Both plow and horse team averaged 4.32 acres per day.

It is concluded that, owing to the relatively high cost of tractor work as compared to that of horses, the tractor is not yet the most efficient means of doing agricultural work, and that in South Australia it can not yet compete with horses in this respect.

Plowing test, P. J. SHAW (*Nova Scotia Sec. Agr. Ann. Rpt.*, *1919*, *pt. 1, pp. 76–78*).—A comparative plowing test on low heavy land of an American plow with short abrupt moldboard and short handles and a Canadian plow with a long moldboard, narrow bottom, and long handles showed that the drafts of the two plows were practically the same.

Plows and plowing, J. M. SMITH ([*Saskatoon, Canada*]: *Author, pp. 19, figs. 17*).—Practical information is given on plows and their adjustment and on plowing.

The pulverizing machine in the cultivation of virgin and cultivated soils, J. V. GRANQVIST (*Svenska Mosskulturfor. Tidskr.*, *34* (*1920*), *No. 5–6, pp. 333–339, figs. 7*).—A rotary pulverizer for use on virgin and other soils in Sweden is described and illustrated.

Proceedings of conference of men engaged in grain dust explosion and fire prevention campaign conducted by U. S. Grain Corporation in cooperation with Bureau of Chemistry, U. S. Department of Agriculture (*New York: U. S. Grain Corporation, 1920, pp. II+159, figs. 8*).—These proceedings contain the following special articles: Possible Lines of Extension of Dust Explosion Work in Commercial Fields, by H. R. Brown; Changes in Elevator Construction Suggested by Recent Explosions, by J. O. Reed; Latest Developments and Devices for Prevention of Chokes in Elevator Legs, by P. E. Brady; A Discussion of the Relation of Grain Dust Explosions as Applied to Flat Warehouses and Elevators, by G. P. Bodnar; Experiences That Have Been Helpful in Making Inspections, by G. A. Hibbard; Static Electricity in Attrition Mills and Methods of Removal, by M. E. McCollam; Recent Investigations of Static Conditions in Industrial Plants, by H. E. Roethe; Relation of Electrical Equipment to Dust Explosions, by D. J. Price; Special Features in Lighting, by E. B. Fox; Presentation of Dust Explosion Work Before High School Students, by E. L. Riley; Review of Explosions during Past Year; Suction *v.* Bucket Elevating in Handling of Grain, by G. D. Witmer; Relation of Aspirating Systems in Grain Elevators to Dust Explosions, by W. D. Lind; A System of Air Purification in Flour Mills, by H. J. Helmkamp; and Results and Impressions in Dust Explosion Meetings, by H. H. Brown.

Wire fence construction, C. L. MORGAN (*Clemson Agr. Col. S. C., Ext. Circ. 21 (1920), pp. [4], figs. 2*).—Brief popular information on woven wire fence construction is given.

Proceedings of National Conference on Concrete House Construction, Chicago, February 17, 18, 19, 1920 (*Natl. Conf. Concrete House Construct. Proc., 1920, pp. 235, figs. 71*).—These proceedings contain the reports of a number of committees on matters related to houses and housing, and the following special articles: The Moral Value of the Individually Owned Home, by J. M. Vander Muelen; Housing Needs from the Viewpoint of Industry, by J. Glass; Concrete Housing, by I. K. Pond; Relation of Design and Public Taste to the Housing Problem, by H. K. Holsman; Cooperation with Building and Loan Associations in Financing Individual Homes, by M. D. Rider; The Government's Housing Experiment, by L. K. Sherman; The Concrete House and Its Status as Regards Building Codes, by F. W. Loomis; Insulation of Concrete Walls, by N. D. Mitchell; and New Developments in Surface-Treated Concrete and Stucco, by J. C. Pearson and J. J. Earley.

A poultry house for twenty-five hens, A. G. PHILIPS and C. W. CARRICK (*Purdue Agr. Ext. Leaflet, 113 (1920), pp. [4], figs. 3*).—Working drawings of a poultry house for 25 hens are presented and discussed.

A farm poultry house, H. M. LACKIE (*Wyo. Agr. Col. Ext. Circ. 4 (1920), pp. 11, figs. 9*).—Brief popular information on the planning and construction of farm poultry houses for Wyoming conditions is given.

Silo capacity, H. H. MUSSELMAN (*Michigan Sta. Quart. Bul., 3 (1920), No. 2, pp. 67, 68, fig. 1*).—Graphic data are given to estimate the weight of silage originally contained in a silo and the amount remaining after a certain amount has been removed.

Research work on insulating materials (*Ontario Agr. Col. and Expt. Farm Ann. Rpt., 45 (1919), pp. 47–49*).—Laboratory studies of the relative insulating values of several materials showed that very fine black regranulated cork had the highest insulating value, followed in order by chopped straw, coarse black regranulated cork, forest leaves, sawdust, excelsior, and planer shavings.

The transmission of heat through single-frame double windows, A. N. SHAW (*Jour. Amer. Soc. Heating and Ventilating Engin., 26 (1920), No. 9, pp. 773–786, figs. 9*).—Approximate preliminary calculations show that the quantity of heat transmitted through single-frame double windows is about 0.5 B. t. u. per square foot per hour per degree Fahrenheit difference, that the variation of this quantity with the thickness of the window is small, and that in the particular case of ½ and ¾-in. windows the difference should be less than 5 per cent.

Ten experimental determinations of the actual transmission of heat through ¾ and ½-in. single-frame double windows led to the final conclusion that these sizes will transmit between 0.6 and 0.7 B. t. u. per square foot per hour per degree Fahrenheit difference and that the percentage difference for the two sizes will be less than 2.5 per cent. A description is given of the apparatus used in conducting these experiments and the theory forming the basis of the experiments and methods of procedure is outlined.

Proper selection of hot-water heating devices for domestic service, A. BUENGER (*Jour. Amer. Soc. Heating and Ventilating Engin., 26 (1920), No. 8, pp. 701–713, fig. 1*).—General principles for the selection of hot-water heating apparatus for domestic use are established.

One-register furnaces (pipeless furnaces), A. M. DANIELS (*U. S. Dept. Agr., Farmers' Bul. 1174 (1920), pp. 12, figs. 7*).—This very briefly discusses the

principles and the advantages and disadvantages of the one-register, warm-air house-heating system, illustrates the circulation of cold and warm air in the rooms, and points out conditions under which satisfactory service can be expected.

The system consists essentially of a heater with a single register located directly above it. Warm air passes up through the center part of the register and the cooler air is conducted downward through the outer part of the register between an inner and outer casing to the base of the furnace. As the heated air leaves the center part of the register it rises straight to the ceiling and diffuses through all the rooms that open into the main room or hall in which the register is located, forcing the colder and heavier air to the floor. From there it is drawn back continually into the furnace through the return inlets. There must always be an unobstructed passage for the air from room to room. One of the essential requirements of the system is to install the furnace approximately under the center of the first floor.

This system does not provide ventilation, since it recirculates the air over and over again and must depend on the opening of doors and windows and on infiltration for its supply of fresh air.

Septic tanks for rural homes, H. B. Roe (*Univ. Minn. Agr. Ext. Div. Spec. Bul. 50 (1920), pp. 20, figs. 14*).—The author summarizes his own experience and that of others on the design and construction of sewage disposal systems for rural homes, and presents working drawings and bills of material and labor for the construction of standard systems.

It is concluded that the best and simplest sewage disposal plant for the individual rural home at present is a 2-chamber septic tank connected to a tile drain having a good outlet or leading to an absorption bed. The general shape of the septic tank should be rectangular, the sludge chamber being about twice as long as it is wide and not more than 4 ft. wide, with a fluid depth of about 30 in. and an air space above the scum of approximately 1 ft. Light, acids, and greases should be excluded from the tank and the entrance and discharge of matter should be so controlled as to prevent disturbance of the scum. The sludge chamber should be of a size to accommodate house discharge up to 30 gal. per capita per 24 hours.

Subsurface sewage disposal, W. A. Hardenbergh (*Pub. Works, 49 (1920), No. 24, pp. 553–556, figs. 7*).—A compilation and comparison of the recommendations of a number of State boards of health and other authorities on the structural details of subsurface sewage disposal systems, as well as the area and kind of soil necessary, are given.

Notes on the design and principles of sewage siphons, W. Gavett (*Engin. News-Rec., 85 (1920), No. 22, pp. 1041, 1042, figs. 2*).—A brief exposition is given of the theory upon which the design of sewage siphons is based, together with data from comparative experiments on discharge from siphons of different makes. The desirability of accurate data on friction losses through siphons is emphasized.

Electric service in the American home (*Elect. World, 75 (1920), No. 20, pp. 1133–1137, figs. 2*).—The results of a study of reports covering the details of electrical service in more than 10,000 cities and towns and the surrounding country districts in the United States are presented. The study included reports from more than 5,000 central stations.

It was found that 30.7 per cent of the people of the United States live in electrically lighted homes, and that 6,291,160 houses are wired. There are about 340,000 farm lighting plants.

RURAL ECONOMICS AND SOCIOLOGY.

Farm profits—figures from the same farms for a series of years, H. M. Dixon and H. W. Hawthorne (*U. S. Dept. Agr. Bul. 920 (1920), pp. 56, figs. 19*).—Studies in continuation of some of those previously noted (E. S. R., 30, p. 490; 39, p. 893; 41, p. 90) are reported on, the areas studied including 25 farms for 7 years in Palmer Township, Washington County, Ohio; 100 farms for 7 years in Forrest and Johnson Townships, Clinton County, Ind.; and 60 farms for 5 years in Verona and adjoining townships, Dane County, Wis. Graphic illustrations show the distribution of farm area, crop area, receipts, expenses, gross income, and labor income on the basis of the average for each region surveyed.

Summaries of the farm business for the group by years, yearly labor incomes, and percentage returned on investment in the period covered, as well as labor income, crop area and yields, crop acres per man and horse, pasture area, productive animal units, and live-stock returns on each of the farms are tabulated. Averages, maximum and minimum, and index figures are shown in the same connection.

The following table has been devised from the authors' summary of results:

Summary of returns from certain farms in Ohio, Indiana, and Wisconsin.

Locality.	Number of farms.	Period.	Farm income.	Labor income.	Return on investment.	Estimated value of rent, food, and fuel.
					Per ct.	
Washington County, Ohio	25	1912–1918	$610	$276	4.6	$359
Do	25	1912–1915	468	153	2.8	(1912) 300
Do	25	1916–1918	800	441	6.6	(1918) 404
Clinton County, Ind	100	1910, 1913–1918	1,856	558	5.7	425
Do	100	1910, 1913–1915	1,407	205	4.5	(1910) 356
Do	100	1916–1918	2,454	1,028	7.0	(1918) 620
Dane County, Wis	60	1913–1917	1,293	408	4.7	391
Do	60	1913–1915	985	113	3.2	(1913) 351
Do	60	1916–1917	1,754	850	6.8	(1917) 525

Four out of the 185 farmers in these three areas made over $500 labor income every year, 33 failed to make a $500 labor income in any year of the period, 4 farmers allowing the value of their own time made over 5 per cent return on their farm capital every year, and 18 did not reach this return in any one year. The returns on the farm capital, when averaged for the period of years, ranged from 2 to 8 per cent on most of the farms, 52 per cent of those in the Ohio area, 86 per cent of the Indiana farms surveyed, and 78 per cent of those in the Wisconsin area falling within this range. After making fair allowance for their own labor, 3 farmers in the Ohio area realized over 8 per cent return, 10 in the Indiana area, and 3 in the Wisconsin area. Four others in the Ohio area, 12 in the Indiana area, and 10 in the Wisconsin area, however, failed to make any labor income, while 9 in the Ohio area, 4 in the Indiana area, and 10 in the Wisconsin area realized less than 2 per cent return. Various factors affecting profits on different farms of each region are briefly discussed.

Some natural laws of agricultural production and their economic corollaries, D. Taruffi (*Atti. R. Accad. Georg. [Florence], 5. ser., 17 (1920), No. 2–4, pp. 60–70*).—Several phases of the laws of diminishing returns and of proportions in animal and plant production are briefly set down and discussed. The author finally illustrates the relationship between increased returns with successive additions of labor, fertilizers, or other factors in increased yields with the idea of the parabolic curve. It is pointed out that while the point may finally be reached where successively intensified methods would not result in an increase in the product, the economic return or profit arising from the

practice will certainly reach a point less than nothing or become a loss. It is suggested that the study of the correct proportions of natural and economic factors in production with the end in view of assuring the highest return opens to agriculture a wide horizon of intensive development.

Possibilities of increased production in our rural industries, A. J. Perkins (*So. Aust. Dept. Agr. Bul. 126 (1919), pp. 32*).—It is said that very little really suitable agricultural land remains in South Australia for allotment or clearing, so that increased production and wealth from the soil will come rather from increasing the mean returns of existing industries, particularly wheat raising. Means of developing this, as well as dairying, live-stock raising, fruit growing, and minor projects, are discussed.

Some tables relating to crop valuations and live-stock returns in South Australia in recent years are given in the appendix.

The recent agrarian agitation in central Italy and the economic conditions of share renters, G. Tassinari (*Atti. R. Accad. Georg. [Florence], 5. ser., 17 (1920), No. 2-4, pp. 153-175*).—Following a brief survey of the main types of landholding and of characteristic forms of lease contracts in three departments in central Italy, Tuscany, Umbria, and Marches, this paper describes the typical classic share-renting or metayage contract, giving its main clauses and secondary or auxiliary agreements sometimes pertaining thereto.

Demands made by renters are said to include the requirement of a written contract definitely stating the obligations placed on each party, in the place of such agreements as customarily existed, which left much to the discretion of the proprietor; a change in social relationships, which left the tenant in the position of more or less servile dependency; an increase in the profit for the tenant, and the immediate realization on the part of the renter of those increases resulting from war conditions, the latter being one of the advantages which would arise from required annual rendering of accounts.

Certain data, collected under the direction of C. Papi of the Royal Higher Agricultural Institute of Perugia on a group of 36 plains farms of from 18 to 40 hectares and of 20 hill farms of from 10 to 18 hectares, altogether making up a bishopric holding in the Tiber Valley between Perugia and Todi, are reviewed in some detail, comparing returns for the period 1909–1914 with those for the years 1916, 1917, and 1918. It is indicated that the returns to the renter's family were about tripled in 1917 as compared with the average for the prewar years, and multiplied about five times in 1918. The increase was due most largely to increased profits from live stock.

The author concludes that detailed studies similar to this on the economic condition of tenants are imperative. It is his opinion that the agitation arises not so much from the real economic difficulties as from socialistic propaganda.

The agitation among the peasants and the future of the share-renting system, P. F. Serragli (*Atti. R. Accad. Georg. [Florence], 5. ser., 17 (1920), No. 2-4, pp. 95-144*).—A detailed résumé is given of the unrest among Italian peasants in agricultural districts through a number of years. It is shown how in particular districts the agitation was quieted by arbitration and the demands for modified terms of share-lease contracts were met, but that under the influence of socialists and the so-called people's party strikes are still organized and carried out frequently in various parts of the country. The author contends that this discontent is due to propaganda rather than to any real economic disadvantage to the peasants under present renting sysems.

Comparisons of systems of small holding, D. Taruffi (*Atti. R. Accad. Georg. [Florence], 5. ser., 17 (1920), No. 2-4, pp. 86-94*).—Means of providing

credit to small farmers in Prussia are outlined and briefly compared with Italian systems. State encouragement and aid in the acquisition of small holdings and laborers' units is recommended, with the reservation, however, that since prices of agricultural products have not kept pace with present land prices, this factor must be taken carefully into consideration in order to prevent the undertaking of too large a number of such projects to insure economic success to the individuals.

Relationships between income and property value, A. Ostermayer (*Nachr. Deut. Landw. Gesell, Österr., n. ser., 4 (1920), Nos. 11-12, pp. 69-74*).—This is an extract of a study by the author of the appraisal of land as the basis for the levying of a property tax, published in 1915 under the title The Land as a Source of Income. The author is in agreement with Aeroboe, who in his book, The Taxation of Estates and Other Forms of Landed Property, considers land values to be based on subjective elements as well as objective financial factors. He discusses two methods of evaluation of property for purposes of taxation, the one which he considers more tenable being based on local exchange on market values obtaining in a given community as a unit rather than on the selling prices of indiscriminate large and small individual parcels, and the other being based on the capitalization of income.

Laur of the Swiss Peasants' Secretariat advocates the second method, and has worked out a system in which the yield value and basis for taxation is determined from the net income, the latter term being used to designate that part of the gross return remaining after the satisfaction of all costs, amortization payments, and wages for family labor, without, however, subtracting interest. Aeroboe holds this impracticable for taxation purposes, and would add a correction to include the purchasing power of the income and the personal subjective demands of the purchaser for a home rather than for a mere means of realizing a definite sum of money.

By tabulations of a series of figures for selling prices, income, indebtedness, labor income, etc., from a large number of properties, the author compares the earning value calculated by the Laur method with the capital value estimated on the community basis. These figures are variously analyzed and show that the calculated earning value is in no case equal to the actual sale value of the land. The latter was, in fact, from 808 to 962 crowns higher than the former in the properties under consideration, and the difference between this income value and sale value was less the more the percentage of net income in the total agricultural income increases in proportion to the labor income.

All points considered, it is admitted that a close relationship exists between net income and exchange value, but since this decreases as the labor income increases in proportion to the total agricultural income, the assumption is justified that in the determination of land values the possibility of obtaining a labor income along with productivity of capital plays an important rôle. It is the more important, the more the land takes on the character of a labor instrument.

The author concludes that increase in value due to the consideration that land ownership affords a constant assured opportunity for the operator's labor can not be ignored in tax assessment. A systematic collection of data on market values for land on the basis of important agricultural and industrial areas is said to be a field for important scientific studies demanded by the necessity for a fair tax scale for Austria.

A scale of wages based on wheat prices, A. Beckerich (*Jour. Agr. Prat., n. ser., 34 (1920), No. 36, pp. 196-198; rev. in Wages Bd. Gaz., 2 (1920), No. 56, pp. 547, 548*).—Daily and monthly wages of various classes of agricultural laborers are fixed by an agricultural society of Melun, France, in the vicinity

of Paris, on a sliding scale based on prices for wheat, allowing, for example, an increase or decrease of 50 centimes above or below 15 francs a day following a rise or fall of 5 francs above or below 100 francs a quintal for wheat as laborers' wages, without board, lodging, or allowance of any kind. The English commentator points out that this is considerably above the rate fixed for England by the Agricultural Wages Board as a minimum, but that the apparent disparity is counteracted by the higher cost of commodities in France.

Farm inventories, J. S. BALL (*U. S. Dept. Agr., Farmers' Bul. 1182 (1920), pp. 31, figs. 4*).—This explains the uses of farm inventories, and gives directions for preparing and caring for a farm inventory book, classifying and appraising the property items, and determining resources or assets. The appendix contains a sample of a complete farm inventory on a 125-acre farm in western New York, rules for estimating quantities of produce in bulk, and hints on estimating the life of farm implements.

Cooperation among farmers and consumers (*Natl. Catholic War Council, Reconstr. Pamphlet 11 (1920), pp. 31*).—In this pamphlet certain salient features of successful cooperation are set forth, such as membership agreements and management, limited shareholding, the advantage of handling one crop, and the development of the local society and its alliance with the district, regional, and national organization, and the affiliation of consumers' cooperative stores with producers' societies is advocated. The use of the school and postal systems and other plans for the distribution of foodstuffs are described. Suggested and actual legislative measures relating to cooperation are exhibited in appendixes.

First cooperative congress for Argentina (*Bol. Mens. Mus. Soc. Argentino, 8 (1919), No. 94, pp. 257–759+[2]*).—A commission was appointed in April, 1918, for the consideration of cooperation in general and the present status of cooperative credit societies and their relations with banking establishments. This volume reports the sessions of a congress called at the instigation of this commission and meeting October 12–17, 1919, at Buenos Aires. The program covered legislation favoring cooperatives, cooperation for production, consumers' cooperation, cooperation for credit and insurance, agricultural cooperative societies, and professional syndicates. A number of legislative measures with regard to these activities are outlined.

Agricultural insurance: Hail and live-stock insurance, A. FRATZSCHER (*Landwirtschaftliche Versicherung (Hagel- und Viehversicherung). Berlin: Ernst Siegfried Mittler & Son, 1914, pp. IX+167*).—This one of a series of works on insurance, edited by A. Manes, covers various phases of the subject, such as the historical development of hail insurance in Germany since the end of the eighteenth century to the present time, the several forms and the principles of organization, the legal basis, and technical features of operation, such as the selection of risks, the determination of premiums, and estimation of losses, together with brief notes on the status of hail insurance in foreign countries. The question of insurance against losses of live stock and animals intended for slaughter is developed under similar headings.

North Carolina cotton warehouse system: Laws, rules, and regulations governing its administration (*Raleigh: N. C. Dept. Agr., [1919], pp. 16*).—The text of legislation is given with a brief discussion.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3 (1921), Nos. 1, pp. 1–16; 2, pp. 17–32, figs. 4; 3, pp. 33–48, figs. 2; 4, pp. 49–64*).—The usual weekly and monthly summaries, brief articles on domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products, together with analyses of foreign market conditions, are given in these numbers.

In No. 1 there occurs the first installment of a statistical review of the live stock and meat situation in the United States, compiled by the U. S. Bureau of Markets, to be published monthly. The data reflect the conditions prevailing in July, August, September, and October, 1920, with comparisons for the same periods in 1919. Cumulative data from January to October of the same years are also given.

It is noted that the production of vegetable seed is back to normal. Other special articles relate to phases of the live stock and produce markets. In No. 4 is reported a plan agreed upon for the marketing of stocks of Australian wool held by the British Ministry of Munitions, under which Australian growers have assumed responsibility for marketing the entire surplus of Australian wool carried over from previous seasons.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul., 7 (1920), Nos. 38, pp. 12; 39, pp. 8; 40, pp. 6; 41, pp. 7*).—These bulletins continue the usual monthly partial list of products which farmers have for sale. Additional information is given in No. 38 regarding the legal standards for North Carolina in grading and packing fruit and vegetables and sweet potatoes.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 6 (1920), No. 12, pp. 133–152*).—Crop summaries for the year 1920, and for the three years 1918 to 1920, inclusive, are made in this number, in addition to the usual monthly reports on acreage and condition, and brief articles, forecasts, tabulated data as to stocks, farm value, and market prices of important agricultural products, including live stock, are given. Aggregate crop value comparisons, covering 22 crops by States for several years, and wages of male farm labor, 1910 to 1919 and 1920, by States are also shown.

Report of the mission to the United States, December, 1918–March, 1919 (*Dir. Gén. Agr., Com., et Colon. Tunis, Bul., 24 (1920), No. 101, pp. 109–178, pl. 1, fig. 1*).—General impressions of agriculture in this country are recorded, and the organization and work of the U. S. Department of Agriculture are outlined. Reports on agricultural education, dry farming and irrigation farming, production of oranges in California, live-stock raising, and miscellaneous industries as observed by the mission are included.

[Agricultural production in Argentina] (In *The Economic Development of the Argentine Republic in the Last Fifty Years. Buenos Aires: Ernesto Tornquist & Co., Ltd., 1919, pp. 25–32*).—This chapter, in a compilation of information from official publications and other authoritative works and periodicals, is given to a statistical review of the production and yield of the principal grains and other crops, areas cultivated, and exports of the principal cereals and their destination.

Agricultural statistics of Argentina (*Estadis. Agr. [Argentina], 1917–18, pp. 239*).—This volume continues statistical information previously noted (E. S. R., 40, p. 792).

Area cultivated and number of domestic animals in Sweden, June 1, 1919 (*[Sweden] K. Statis. Centralbyrån, Statis. Meddel., Ser. A, 3 (1920), Nos. 2, pp. [3]+81; 3, pp. [3]+182*).—This special statistical report tabulates and interprets data relating to the number of agricultural enterprises classified in size groups, as well as the crops grown and live stock carried on holdings of various sizes in the different territorial divisions. Comparisons are made with returns for previous years.

French East Africa and its raw materials, G. François (*L'Afrique Occidentale Française et ses Matières Premières. Paris: Émile Larose, 1920, pp. [3]+87+[2], pls. 8*).—A study of the production of oleaginous plants, textiles, rubber, wood, live stock, fish, and various native vegetable products in this group of French colonies is presented in these pages.

An agricultural monograph on the region of Urundi, G. De Greff (*Bul. Agr. Congo Belge, 10 (1919), No. 1-4, pp. 1-69, pl. 1, figs. 21*).—This descriptive report covers a general account of the country, the native agriculture, population, customs, and live-stock raising of this French protectorate, formerly one of the provinces of German East Africa. A few figures are given for average prices received for agricultural products and monthly minimum offerings in trade of the same at certain river trading posts.

AGRICULTURAL EDUCATION.

Development of agricultural instruction in secondary schools, H. P. Barrows (*U. S. Bur. Ed. Bul. 85 (1919), pp. 108*).—This bulletin treats of the history of agriculture in secondary schools; progress in State aid for secondary agriculture, especially in the more definite systems in Massachusetts, New York, Pennsylvania, New Jersey, and Indiana; agriculture as taught in some secondary schools representative of district and county schools of agriculture, public high and normal schools, and private schools for white and negro students; the history of the movement for Federal aid for vocational education, and provisions and operation of the Smith-Hughes Act; training teachers of agriculture, including the development of agricultural teaching, the work of the land-grant colleges in the preparation of teachers of agriculture, and practical phases of training; and a summary of study. A bibliography on agriculture in secondary schools is included.

As regards the relation of secondary to collegiate agriculture, it is stated that "the present-day tendency appears to be to consider elementary instruction of a general prevocational nature the work of the elementary schools and the junior high schools, and the work of the agricultural colleges largely the training of scientists and specialists, leaving to secondary schools and departments a large share of the vocational training of farmers." With reference to the kind of school in which agriculture should be taught, the author is of the opinion that "it would seem that there is place for instruction in agriculture in every high school serving a farming community if the school is prepared to give the proper training to future farmers. There is also a place for a limited number of agricultural schools of secondary grade."

The use of land, utilizing the community resources, methods of instruction, the organization of subject matter, and equipment as the chief problems of vocational agriculture are briefly summarized. In the author's opinion, it is to the success of State-aided agricultural instruction that Federal aid for that work must be credited. Although the matter of organization and administration is left largely with the States, there is little doubt but that the tendency is in the direction of national standards.

With reference to the question of the maintenance of specialized vocational training in agriculture in an extensive way without more attention to vitalizing the instruction in general agriculture, it is believed that linking instruction in general agriculture in the upper grades, the junior high school, and the lower grades of the high school with boys' and girls' club work and other home work should serve in an excellent way as prevocational training for agriculture. Further, that inasmuch as there should be close relation between the elementary or prevocational work and vocational training, the supervision of both lines should be under the same direction. Inasmuch as teachers of agriculture are expected to know both the art of farming and the science of agriculture along general lines, as well as the art of teaching and the science of education, departments of agricultural education are finding that this broad training can not all be given in college. To secure men who have good prospects of suc-

ceeding in departments of vocational agriculture from the start, they are reaching out for men who have had either experience in farming or practice in teaching, or both, and then rounding out their training in the college.

The agricultural teacher's annual plan of work, W. G. CRANDALL, A. BARNETT, and V. PETERSON (*Clemson Agr. Col. S. C., Div. Agr. Ed. Bul. 3 (1920), pp. VI+91, figs. 14*).—This summary of plans for teaching agriculture, developed in South Carolina during the past three years, includes the farm survey as the basis of the teacher's annual plan of work; the project in agricultural teaching; the teaching phase, i. e., the proper scope of subject matter for each year's work, and the proper distribution of the total teaching time and work throughout the teaching session; community activities; and work during the summer months.

Project study outlines (*Tex. Dept. Ed. Bul. 121 (1920), pp. 69*).—This bulletin includes project study outlines on corn, cotton, grain sorghums, melons, onions, peanuts, potatoes, sweet potatoes, tomatoes, wheat, hogs, and milk, baby beef, sheep, egg, and poultry production.

A year's work in farm crops and soils for Minnesota, B. M. GILE (*Minn. Dept. Ed., Bul. 1 (1920), pp. 80, figs. 11*).—This bulletin comprises outlines for a year's instruction in growing corn; forage, grain, and root crops; legumes; potatoes; soils and crop rotation; and weeds; together with suggestions for laboratory work and illustrative material, applied farm practice work, time distribution, and references to helpful literature.

Education in poultry keeping, P. A. FRANCIS (*Jour. Min. Agr. [London], 27 (1920), No. 8, pp. 753–759*).—The author briefly reviews the facilities for poultry instruction in England and Wales, including poultry clubs and societies, State assistance, itinerant instruction, and regular courses at farm institutes and farm schools and at the agricultural colleges. The possibilities of the extension of poultry education, especially as regards higher instruction, is discussed.

Poultry keeping in an elementary school in Cornwall, R. R. BLEWETT (*Jour. Min. Agr. [London], 27 (1920), No. 6, pp. 517–520*).—This note briefly describes a chicken fattening experiment, including the economic results, conducted in the spring of 1920 by the upper-class children of the Lanlivery Council School.

Rural education in Wales (*Jour. Min. Agr. [London], 27 (1920), No. 6, pp. 509–512*).—This is an account of an experiment, begun in 1908, in giving an agricultural bias to the ordinary school teaching at the Welshpool County School for Boys. No instruction is given in technical farm processes, but the rural science work taken up is deemed especially suitable for boys who hope to take a degree in agricultural subjects. Further, the rural trend given to the various subjects has contributed to the basis of a good general education, and has tended to make the students more alert and has given them a wider outlook.

The agricultural high school of Hohenheim on its one-hundredth birthday, H. KRAEMER (*Die Landwirtschaftliche Hochschule Hohenheim zu Ihrem Hundertsten Geburtstag. Stuttgart, Germany: Eugen Ulmer, 1918, pp. 24, pls. 15*).—This is an account of the organization and facilities for instruction of the agricultural high school of Hohenheim.

Shall instruction in surveying in Prussia be given at the agricultural or the technical high school? C. MÜLLER (*Deut. Landw. Presse, 47 (1920), No. 16, p. 121*).—The author briefly discusses instruction in land surveying as given in Prussia. He does not favor its transfer from the agricultural high schools at Berlin and Bonn to the technical high schools, but suggests that if a transfer

is imperative provision be made in the philosophical faculties of the universities of Berlin and Bonn.

Educational research in the practical arts, F. G. BONSER (*Jour. Home Econ., 12 (1920), No. 6, pp. 241–245*).—The author defines professional or educational research and gives several illustrations which suggest the variety of possible problems in the field of household arts, centering in general about the organization of curricula, the adaptation of technical materials to school and public uses, the development of special methods of teaching, the working out of problems in equipment for definite purposes, the organization of relationships between technical subject matter and other fields or subjects, and the adaptation of teaching materials and methods in regular schools to special types of schools.

Future administrative problems in vocational education in home economics, A. E. RICHARDSON (*Jour. Home Econ., 12 (1920), No. 7, pp. 299–307*).—The author discusses some of the problems of the administration of vocational home economics education, viz, the groups of women to be reached by such training, determining the kind of instruction which should be given to each group, and the provision of adequately trained teachers.

Practice houses a reality, D. BEACH (*Jour. Home Econ., 12 (1920), No. 7, pp. 308–312*).—A summary is given of information on practice houses received from 32 institutions (19 State colleges and universities, 4 other colleges, 6 normal schools, and 3 institutes) which have a practice house.

Of the State universities and colleges, 11 own and 8 rent their practice houses, 2 or possibly 3 being self-supporting. The houses have from 5 to 14 rooms, with an average of 8, and from 2 to 18 girls work at the same time in the practice house for from 5 days to 18 weeks each. In each institution the girls live in the practice house while working there and carry on other regular courses. In 14 institutions 1 resident instructor carries on the work and in the others, 2. In every instance but one, the instructor does other teaching, which usually includes household management.

Work in the practice house is elective in 3 institutions; required of Smith-Hughes students in 4, of seniors in 8, of both juniors and seniors in 3, and in 1 institution with small attendance is required during all 4 years. Credit given varies from no credit to 6 semester hours. With their practical work these students carry from 11 to 20 hours.

Similar data are reported for the other schools. A description is given of the practice house at the University of Maine, opened September 8, 1919.

Child care in the Oregon Agricultural College practice house, A. G. JOHNSON (*Jour. Home Econ., 12 (1920), No. 8, pp. 348–353*).—The author states that the lecture course in mothercraft first offered in the Oregon Agricultural Collge five years ago has developed from a very condensed one-credit elective course to a three-credit required course in child care. A practice house, in which the laboratory course in household management is offered to junior and senior students, was established in September, 1916. The problems of child care and management as a part of the practice house training are briefly discussed. It is concluded after seven and one-half months' experience that the work in child care, about which the students are enthusiastic, should be continued, because it gives valuable training to the students, furnishes excellent care for the children without spoiling them, makes the practice house more homelike, and helps to train for motherhood. It is suggested that two children of different ages should be taken whenever possible.

The lunch hour at school, K. A. FISHER (*U. S. Bur. Ed., Health Ed. No. 7 (1920), pp. 62*).—This is a discussion of the problems of organization and ad-

ministration of school lunches in rural and other schools. Some typical dishes and menus and a selected list of references on diet are included.

Report of the women's institutes of the Province of Ontario, 1919 (*Ontario Women's Insts. Rpt., 1919, pp. 143*).—This report contains the proceedings of the annual conventions for eastern, western, and central Ontario and the statistical report for 1918–19 on women's institutes in the Province, together with a few reports of representative institutes.

Schools for women's institute organizers (*Jour. Min. Agr. [London], 27 (1920), No. 7, pp. 600–602*).—Information is given on two two-week schools of instruction for women's institute organizers held at Oxford and Aberystwyth. The main subjects dealt with in these schools were agriculture in its historical and more general aspects and the effects and possibilities of local government. Other important subjects were village recreation, home making and hygiene, and the principles and methods of voluntary organization.

MISCELLANEOUS.

Report of Alaska Stations, 1919 (*Alaska Stas. Rpt. 1919, pp. 90, pls. 15*).—This contains the organization list and a report of the several lines of work carried on during the fiscal year ended June 30, 1919. Meteorological data and accounts of the extensive tests with field and garden crops and other lines of work are abstracted elsewhere in this issue.

Thirtieth Annual Report of Arizona Station, 1919 (*Arizona Sta. Rpt. 1919, pp. 391–463, figs. 4*).—This contains the organization list, an administrative report on the work and publications of the station, a financial statement for the fiscal year ended June 30, 1919, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Report of Langdon Substation, 1914 to 1919, P. F. Trowbridge (*North Dakota Sta. Bul. 134 (1920), pp. 32, figs. 8*).—This report briefly summarizes meteorological data and the various lines of work from 1914 to 1919, the experimental phases being for the most part noted elsewhere in this issue.

Thirty-third Annual Report of South Carolina Station, 1920 (*South Carolina Sta. Rpt. 1920, pp. 64*).—This contains the organization list, a report of the director on the work of the station, a financial statement for the fiscal year ended June 30, 1920, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Quarterly bulletin of the Michigan Experiment Station, edited by R. S. Shaw and E. B. Hill (*Michigan Sta. Quart. Bul., 3 (1920), No. 2, pp. 35–72, figs. 13*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: High Protein Roughages for Dairy Cattle, by F. T. Riddell; Testing of Dairy Cattle in Michigan, by E. B. Hint; Duplication of City Milk Delivery, by S. J. Brownell; Manitou Island Rosen Rye, and The Michigan Plan of Developing and Distributing Improved Crops Varieties, both by J. F. Cox; Better Seed Potatoes Produced for Michigan, by H. C. Moore; Commercial Fertilizers on Potatoes, by C. W. Wald; The Conservation of Manure, by Z. N. Wyant; Announcement of Record of Merit Test, by O. H. Burgess; and List of Available Bulletins.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1920), No. 9, pp 129–144, figs. 5*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles on the following subjects: Fall Plowing or Spring Plowing? by M. E. McCollam, and The Experiment Station and the Poultry Industry, by W. A. Linklater.

NOTES.

Illinois University.—Statistics recently collected by the university indicate that 43 per cent of the graduates of the college of agriculture are engaged in farming, 26 per cent in occupations allied to agriculture, such as county farm and home advisors, veterinarians, commercial dairying, and floriculture, and 31 per cent in agricultural teaching, research, graduate study, and related lines. About 50 graduates are now engaged in experimental work.

Vermont University.—A grant of $250,000 has been made to the university for the endowment fund by the General Education Board on condition that the university raises $750,000 from other sources. The income from this fund when completed is intended to be used in part for higher salaries in the colleges of agriculture, engineering, and arts and sciences.

Merton C. Robbins has been appointed to the board of trustees, succeeding the late Theodore N. Vail.

Agricultural Education in Canada.—At the Ontario Agricultural College the men's dormitory, work on which was suspended during the war, is now nearing completion. It is a stone building accommodating about 150 students and will appreciably relieve the existing congestion, as present facilities are for less than 300 students and the attendance in regular courses is over 500.

The new apicultural building at the college was formally opened by Hon. M. W. Doherty, Provincial Minister of Agriculture, during the annual convention of the Ontario Beekeepers' Association. This building is a 2-story tapestry brick, about 65 by 47 ft., costing about $60,000. The main floor is devoted to offices, a reading room, and a microscopical laboratory, and the top floor to a lecture room seating 250 persons. The basement is largely occupied by a honey and wax room and a bee cellar with special devices for ventilation and heat control.

A farm economics department has been established in the college, financed entirely from Provincial funds. Rev. Charles J. S. Bethune, professor of entomology for the past 15 years, has resigned to retire to private life.

The University of Alberta has established a combined course in arts and agriculture whereby the degrees of B. A. and B. S. A. are both conferred in six years. The first two years are spent under the direction of the faculty of arts, while in the third year instruction in science subjects fundamental to the course in agriculture is begun. The last three years are practically all agricultural, but with some work in English, mathematics, and political economy.

Recent appointments at the Manitoba Agricultural College include G. L. Shanks as professor of agricultural engineering, vice L. J. Smith whose appointment in the Washington College has previously been noted, and Dr. C. B. Clevenger, instructor in chemistry in the University of Wisconsin, as professor of agricultural chemistry.

Father Leopold, professor of fruit growing in the Oka Agricultural Institute since 1910, has been appointed director.

Agricultural Education and Research in Great Britain.—*Science* notes that the Royal Agricultural College at Cirencester, the oldest place of agricultural instruction in the British Empire, is facing extinction at the end of the year. This college, founded 75 years ago, has since 1915 been occupied by a girls' school whose tenancy ends at Christmas. The British Ministry of Agriculture and Fisheries is endeavoring to secure the reopening of the institution

for its original purpose, and has promised a small annual grant for maintenance under certain conditions. The raising of £25,000 from private funds is required, however, and steps are being taken to secure this amount.

Prof. T. B. Wood has been selected by the Agricultural Council of England as the representative of agricultural research on the newly organized Agricultural Advisory Committee. The purpose of this committee, which also includes a landowner, a tenant, a representative of agricultural labor, and a woman, is to advise the Ministry of Agriculture and Fisheries on agricultural matters submitted to it.

Four research scholarships have recently been awarded by the British Ministry of Agriculture and Fisheries, on recommendation of the Advisory Committee on Agricultural Science with the concurrence of the Development Commission. These scholarships are for £200 each for a term of two years, and are available for study at institutions either in England or abroad approved by the Ministry. The purpose is to contribute to the development of agriculture by preparing research workers. Two of the scholarships are in animal nutrition, one in entomology, and one in plant bacteriology.

According to a note in *Nature*, headquarters of the British National Institute of Agricultural Botany at Cambridge are expected to be ready for occupancy in August. About 36 acres are provided at the institute for testing grounds, and in addition two tracts of 354 and 39 acres at St. Ives in Huntingdonshire and Ormskirk in Lancashire are available, the former as a seed multiplication farm and the latter as a potato testing station. Wilfred H. Parker has been appointed director. An official seed testing station is to be incorporated with the institute, but with a separate control and director.

An Imperial Bureau of Mycology has recently been established at Kew for the encouragement and coordination of work on the diseases of plants caused by fungi in the British Overseas Dominions and Colonies. One of its functions will be to lend to workers without good library facilities original papers on mycology and plant pathology, and a request is made of authors for copies of reprints, pamphlets, and bulletins. Dr. E. J. Butler, formerly imperial mycologist of the Department of Agriculture of India, has been appointed director of the bureau.

Technical training for agriculturists in France.—A decree of December 6, 1920, creates in the Ministry of Agriculture a section of applied agriculture, mainly for the training of agricultural development workers and directors of large estates. This section will receive each year not to exceed 30 agricultural graduates, one-half from the National Institute of Agriculture and the other half from the national schools of agriculture. The training will extend through 15 months and will be given as follows: From October 1 to April 1 at the National Institute of Agriculture, as well as in the laboratories, stations, and centers of experimentation in the Parisian district; April 1 to June 1 at the National School of Agriculture at Grignon; September 1 to October 15 at the National School of Agriculture at Montpellier; and from October 16 to December 30 at the National School of Agriculture at Rennes. The detailed course will be fixed by the Ministry of Agriculture, and will comprise lectures, demonstrations, practical work, and excursions.

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V

EXPERIMENT STATION RECORD.

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The question has frequently been raised in the last few years whether the identity of the experiment stations is being maintained on a parity with that of previous years or with that of other branches of the colleges. It is realized that the stations are crippled in force and in the means for carrying on their work, that they have been overshadowed to some extent, and that they are not the prominent features in the agricultural colleges they once were. But how far has the effect of these things gone? Has it seriously affected their individuality, their autonomy, their existence as definite, organized agencies for providing the stock in trade of the other branches of college activities? It will be worth while to look into the matter in order to get a clearer view of present conditions, not to darken the picture but if need be to mend the situation.

The experiment station as organized under the Hatch Act is by law a department or branch of the agricultural college, designed to prosecute investigation and experimentation in agriculture. It is the organized research agency of the college, and is conducted under its direction, to supply the basis of teaching as well as to aid the business and practice of farming. As a part of the college, its destinies are largely in the care of the parent institution.

The Hatch Act sets forth certain objects and purposes and imposes certain duties and responsibilities on the station apart from those of the college as a teaching institution. These imply certain requirements, among them a force, funds, facilities, and administration to meet the desired ends. The station is so different in its requirements and relationships, and its obligations are of such a character, that it may properly stand within the institution and before the public as a quite definite and distinct agency. This was evidently the original conception. It is related to the other branches of the college in various ways, and to some extent may share with them in equipment, facilities, and working force. But research is so specialized and so different from the other lines of activity that in a large sense the station needs a force and facilities of its own, or which it can at least command for its use.

The experiment station is not designed as an aggregation of separate departments, each one working independently and to itself, but as an organized body of workers having many interests in common,

needing policies to guide it and means of expressing itself and working out its destiny. It is not a body which any department may join at will, or participate in the privileges of without assuming obligations of service and of conformity to established requirements. It is an entity, and the Hatch Act had that in mind when it extended to it in the franking of its publications a privilege which was not applicable to other parts of the college.

Even in the early days when the stations were far smaller it was accepted that there was advantage in having this special branch properly organized and provision made for its administration. From the first this Office has advocated a strong, compact station organization, and experience the country over has afforded much proof of its desirability. The fact that it is within and a constituent part of a larger organization does not alter its organized character, or its need for special guidance and supervision. Rather is this need emphasized by affiliation of the members of its force with numerous subject matter departments in the college representing a variety of functions, which suggests the importance of means for securing the necessary degree of unity and cohesion in the station. Unification under a strong organization is further indicated by the character of problems it deals with, which are often wider in scope than single departments and call for a considerable measure of cooperation.

The purpose of the station is now viewed more broadly than it originally was, and the present view of the agricultural industry and what it implies gives a wider range to investigation helpful to it, all of which tends to increase rather than to minimize the importance of effective organization. The larger the enterprise and the more numerous its contacts, the greater the need for a directing influence. The station must preserve its relations to the public and to education, and in carrying out its special function it must keep within the limits of its field and make it possible for other agencies to prosecute their special work effectively.

There seems little doubt, however, that the station organization has weakened in the past few years, and become a less definite unit of the institutions. This is borne out by the existing provision for it and the trend of developments as indicated by the following conditions.

The station directorship was from the first a position of recognized importance. A director was considered essential, and the manner in which that office has been conducted has been a very vital factor in determining the growth of the stations and their development as institutions for research. In recent years, however, the office has lost much of its distinctive character, and its duties have been merged

with other duties to an extent which has left far less opportunity for serious attention to the station.

Ten years ago the station directorship at twenty-nine institutions was a separate office, the incumbent giving his primary attention to station affairs, while in twenty-one States it was combined with that of dean or (in two cases) president. At the present time the condition is practically reversed; the directors in twenty-eight stations have other duties, usually those of dean, and in nine cases those of director of extension as well. Nine other station directors are also directors of extension.

It will be recognized, moreover, that while this change has been taking place the agricultural colleges have made large growth, both in size and in the complexity of their work, and agricultural extension has had almost its entire development. Hence, the demands on the deans and other combination officers have greatly increased over what they were ten years ago, when a separate administrative officer for the station was more common. At present considerably less than half the stations have an administrative officer to themselves, while the remainder receive such attention as can be given from other engrossing duties. Although five stations have appointed an assistant or vice-director to whom more or less of the details of administration are assigned, it will be obvious that on the whole the provision for administration has quite materially declined, and the management has been merged with other duties which have grown greatly in scope and complexity. It has become in large measure incidental.

Such an enterprise as an experiment station calls for hard study to develop the basis of constructive growth and increasing efficiency. It is easy to get into a rut. There needs to be constant forward looking and critical self-examination. A round of routine is not necessarily progress.

Another factor in this connection is the attention given to special qualifications in filling the position of director. The directorship of practically half the stations has changed during the past six years, in five cases twice. Of these twenty-eight administrative changes, it may be noted that in all but three cases the vacancies were filled by persons who had not had previous experience in directing a station; but what is more significant, half of them were likewise new to station work, only a small part having been previously engaged in investigation. This is a rather surprising change in the system for administering the stations. Obviously, it does not mark an advance in the provision for experienced leadership in the research field, and the inference is that in the selection the college was actuated by other reasons than those specially related to investigation.

The working force of an experiment station is the primary measure of its strength and its greatest resource in prosecuting its work. In

the differentiation of function in the colleges, it might naturally be expected that since research calls for concentration and freedom from interruption, there would be an increasing segregation of a special station force with duties primarily connected with investigation, leaving to others the teaching and other branches of effort. This would seem natural also from the growth in other branches of the college which make larger demands on time, if not from consideration of the station welfare. But instead of this, the reverse has taken place. Here also the station has been spread out thinner, not only to cover its own field but that of the college.

As stated in a previous issue, the practice of requiring dual service from station employees has considerably increased, so that there are many less persons engaged exclusively in the service of the station to-day than there were ten years ago. In 1911 a little less than 43 per cent of those on the station staffs had teaching or other duties in the college, while at the present time the proportion is fully 60 per cent. Beyond this, the relative amount of college work required of these dual-service employees has grown materially, owing to the pressure on the colleges and the difficulty of finding suitable instructors.

Moreover, the station staff is less definitely constituted at present than it was a decade ago. There is a growing tendency to list on the station staff practically everyone on the agricultural faculty who might carry on investigation. Indeed, several of the colleges make no attempt to constitute a station staff apart from the faculty as a whole; and often no very definite distinction is maintained between the work of graduate students in degree courses and the systematic investigation carried forward under definitely constituted station projects.

Such mixed administration and the mixed or indefinite composition of the station staff tends inevitably to detract from the unity and individuality of the experiment station. There is little to bind the staff members together or familiarize them with its work as a whole. At many institutions they are rarely called together as a station body, but only as the faculty of the college of agriculture. This naturally goes a considerable way toward eliminating the station as an organization except in purely financial matters.

There is some confusion, also, between the graduate instruction and that of the station proper. Frequently such instruction is conducted by staff members wholly in the pay of the station, and the theses are published in the station series. Such work may promote research, even of the highest fundamental character, and on occasion it may have a very important relation to the station work in the advancement of knowledge; but, obviously, it ought not to be confused with the systematic work of the station. The latter is not de-

signed as a graduate school, and a body of graduate students headed by the professors in charge does not constitute an experiment station. The tendency to blend these two agencies has the effect of further minimizing the station and detracting from its special character. This sometimes goes to the point where there is doubt on the part of department heads whether given pieces of work are station work or not, indicating that no real distinction is attempted. In such cases there is naturally little remaining of a station organization or recognition of such an agency in the State. The condition is in sharp contrast to that of extension.

It is perhaps natural that with a sharper definition of function in other lines, the field of the station should show a tendency to expand increasingly outside the domain of agricultural investigation. It has always provided for considerable regulatory work, and this has steadily grown in kind and amount to include, besides the regular inspections or analyses of feeds, fertilizers, seeds, nursery stock, etc., such things as stallion registration, advanced registry tests, egg-laying contests, forestry promotion and administration, certificates of ability in milk testing, and various other things.

In addition, other extraneous duties have been assigned to the station, such as the management of the college farm and other lands, and the carrying on of memorial farms or properties given to the college for such use as it might make. In several instances it is responsible for the only available facilities for instruction in animal husbandry, dairy farming, dairy manufactures, and the like. The head of one of the older stations said recently that the station administrative officers were no longer directors of research, since the stations had become so complicated and had had joined to them so many things only remotely related to their activity.

The effect of such a variety of duties is to confuse the public as to the real work and function of the station, and there are some evidences, moreover, that it serves to confuse local authorities. Not only does it deprive the station of its distinctive character, but it fails to discriminate between the research activities of the station and those of a general service bureau for the college and the State.

Moreover, it does not clarify the public view when a report designated as the annual report of the experiment station contains the record for the year of the whole college of agriculture, with much prominence to agricultural extension and other teaching and publicity activities. If such confusion exists, it is quite likely to extend to the particular needs of the station and the finances at its disposal.

As a matter of fact, much difficulty has been experienced in securing more than a quite approximate statement of the funds available to the station, or those employed in connection with experiment

and investigation. This is due to the failure of the college to segregate the station appropriations. For example, in several universities the State appropriation reported for the station comprises approximately the whole amount allotted to certain departments of the agricultural college, without respect to the amount devoted to the station activities. In other cases the station's share is a rough percentage approximation. Again, the State appropriations or allotments for the stations have carried the whole or part of the State fund for extension, and other appropriations made in the name of the station have, under their provisions, been shared with the extension division. In other cases the appropriation, while charged up to the station, is so drawn as to be applicable to various other uses.

Such practice is a distinct disadvantage to the stations. It gives a quite wrong impression both within and without the institution of the support accorded investigation, and makes the station responsible for funds which contribute but sparingly to its welfare. Naturally it increases the difficulty in securing added financial support. As far as the institutions are concerned it may properly be taken as an indication or a result of an absence of clear identity.

How large this error may be and how far it may mislead both the public and the authorities themselves is indicated by the fact that the total revenue of the stations, amounting to more than $7,400,000 as reported by the institutions, shrinks on critical examination to something like $4,500,000 for investigation and experiment, including the Federal funds.

Many of the stations have no budget of their own and are not specifically mentioned in the budget of the institution. Allotments are frequently made to departments of the college out of the general appropriations, without designating the amounts assigned to the station work; and the funds which may be used for that purpose are such as can be found through economy in the general administration of the departments. The size of the assignments is often dependent on the needs of the institution in other lines, and fluctuates from year to year.

In numerous instances the needs of the station are not set forth in separate estimates but are combined with those of the larger organization, and in presenting these estimates to the legislature no special reference is made to the station. In such cases the public does not have the requirements of the station placed before it, and the station does not have its day in court. It is therefore cut off from a contact which is important to it, and its chance weakened of receiving the support it must have to grow. The extension work is not subjected to such a large element of chance.

A recent writer has charged the public with having abandoned interest in agricultural investigation—of almost total neglect, "even

a reversal of the policy of the Nation as a whole and every State in it." He adds that "after having established the best [station] system in the world, the country has turned its back on its best piece of work." Leaving aside the question of whether the stations' cause has been adequately presented to the public, it is a fact that, even with the appropriations made by some of the stations last year, the total for 1920 stands at practically the same figure as for 1914, six years previous. Six States report decreases in appropriation during that period, aggregating nearly $178,000. Only twenty States show an increase in those six years amounting to as much as $10,000 or over. For twenty-eight States the increased State appropriation ranged from nothing up to $10,000, aggregating $87,000 for this group of considerably more than half the total number. This gives an average for those States of a little more than $3,000 in six years, or $500 a year in this period of unprecedented cost.

But more money was appropriated to the colleges in that period than ever before. These same twenty-eight States increased their extension funds through direct State appropriation by a total of approximately a million and a half dollars, equivalent to an average of over $50,000 per State. When this average State appropriation for extension is compared with the average of $3,000 by the same States for the experiment stations, the neglect of the stations stands out in its naked reality. Perhaps the accounting system and the financial statement has misled both the public and the local authorities. If so, this may be due to less serious attention to its affairs.

Fortunately, the past winter has seen considerable effort in behalf of larger support for research. While it has resulted in gratifying increases in a number of States, the relief has by no means been general or such as to reinstate the stations in their former position.

It is manifest, therefore, that as a group the stations are not the prominent features in the colleges that they once were, and that they have lost much of their former unity and individuality. There are exceptions, of course, but in the main they have grown neither in resources, man power, nor prestige, while other branches have grown enormously. To an extent their condition represents a symptom, one which money alone will not remove.

Research has so long been one of the recognized functions of the colleges that it should need little argument for its support or the development of a progressive attitude toward it. It is necessary to all the other educational functions of the college; it is the ladder by which they have reached their present efficiency and popularity. It is proper, therefore, that it should be fostered in a manner not only of sympathetic understanding but of absolute concern—that it should

take the form of a well defined. progressive policy for the experiment stations. The fate of the stations very largely depends upon it.

The dean of one of the large agricultural colleges has said in his last report: "It may fairly be maintained that the experiment station is the most vivid feature in the system of agricultural education. It is not merely a continuing source of new truth, but also an effective agency in keeping alive in an institution the spirit of research—that attitude of mind which patiently examines the evidence before reaching a conclusion and is as essential to the honest presentation of truth as to its discovery." It is right to expect that a realization of this will be expressed in the attitude of the college—an attitude which is not only appreciative but aggressive in its behalf. It calls for more pronounced action than in the case of certain other branches which in a large measure now carry themselves. As has been said, because research does not have within itself the elements of publicity, it needs to be guarded by organizations and persons who understand its fundamental importance.

The changes of the past few years have brought the experiment stations into a different environment. Unaided they are not able to cope with the conditions of this new environment and make their way forward in competition with other branches of the institution. Even less successfully can they do so when they lack organization and when they have become so merged with other organizations and functions of the colleges that they no longer stand as the same definite, united branch of effort that they formerly did.

It does not necessarily require oversight or affirmative action to result adversely to the station. Inconsiderate action which does not take account of the possible effect on the station may be quite as serious. This is true also of diminished provision for attention to planning for the station, asserting its place in the institutional scheme of advancement, or protection of what it already has. Such reflex action is often one of the large factors in the situation, and it is not so much to be wondered at when the growth of the colleges has been so rapid and accompanied by such an expansion of interests and responsibility.

Interest in the smaller things has been on the wane. There is a tendency to stress things that are done on a large scale, which offer opportunity for rapid expansion, bring credit and popularity, and aid in helping to get funds for the whole institution. It is the appeal of larger opportunity for service, but unless guarded it is in danger of engulfing the most fundamental feature in a type of organization that is disadvantageous to it, in placing it in the hands of those with whom its interests are not primary, and of dissipating the efforts of its personnel, the life blood of research.

In what has been said there is no reflection upon the agricultural extension service. The magnificent growth it has made and the success it has so rapidly achieved is a matter of common pride. It has become a forceful ally of the stations. It recognizes research as an essential foundation of its work, and it is giving intelligent and hearty support to the stations. It has built a strong organization, and its strength is in no small measure due to that organization. It has established an identity which has given it a recognized place, and defined its scope and function. It is just as important that the experiment station should have such an individuality and an organization suited to its special needs.

How far the present depressed condition of the experiment stations is the outgrowth of an attitude, a diminished identity, a merging of organization, it is not necessary to determine. But whether the condition is a symptom or a product, it is clear that the provisions made for the stations have not enabled them to assert themselves or served to check the drift of circumstances. A well-defined and aggressive policy has become one of the obvious requirements, not only for the progress of the stations themselves, but for the future welfare of the work of the college as a whole.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Physiological chemistry, A. P. MATHEWS (*New York: William Wood & Co., 1920, 3. ed., pp. XIV+1154, pls. 2, figs. 112*).—In the third edition of this textbook on physiological chemistry (E. S. R., 34, p. 607) the most important revisions have been in the practical part, which has been rearranged, largely rewritten, and considerably enlarged to include many new and important methods, particularly in blood analysis. These are illustrated by diagrams and photographs of the apparatus employed. The revision of the theoretical part has been most extensive in the chapter on vitamins.

New fields of phytochemical research opened up by the cultivation of medicinal plants on an economic scale, E. KREMERS (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 1018–1020*).—Attention is called to various phytochemical problems that have arisen in connection with the cultivation on an economic scale of digitalis, hyoscyamus, and peppermint, these plants having been selected at random "to point out how large technological operations and the biochemical study of plants should work hand in hand for the advancement of plant chemistry."

The production of acetaldehyde by certain pentose-fermenting bacteria, W. H. PETERSON and E. B. FRED (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 29–46*).—In this study of acetaldehyde formation in the fermentation of carbohydrates 3 types of pentose forming bacteria were used, an organism related to the colon-aerogenes group and designated as culture 26, *Bacillus acetoethylicum*, and *Lactobacillus pentoaceticus*. The aldehyde was fixed by means of either calcium or sodium sulphite and determined by the method of Neuberg and Nord.[1] Sodium sulphite proved more effective than calcium sulphite as a fixative, but owing to its alkalinity the amount that could be added was limited.

The amount of aldehyde found was proportional to the amount of fixative used and ranged from 0.02 to 0.157 gm. per 100 cc. of culture containing 2 per cent of the carbohydrate. Aldehyde was produced from glucose and starch, but the maximum yield was obtained from xylose. An increase in the amount of aldehyde formed was accompanied by a decrease in alcohol and an increase in volatile acid.

Phthalic anhydrid.—IV, The vapor pressure of phthalic anhydrid, K. P. MONROE (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 969–971, fig. 1*).—A continuation of the investigation previously noted (E. S. R., 42, p. 205).

The use of catalysts in the sulfonation of aromatic compounds, J. A. AMBLER and W. J. COTTON (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 968, 969*).

An apparatus for continuous dialysis or extraction, H. MANN (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 207–209, fig. 1*).—The apparatus described, constructed for the purpose of carrying out dialysis under reduced pressure, is illustrated in the accompanying diagram (fig. 2).

The method of operation is as follows: The material to be extracted or dialyzed is placed in the collodion or parchment bag B, which is suspended in the

[1] Biochem. Ztschr., 96 (1919), No. 1–3, pp. 133–157.

vessel V from the ground glass stopper S provided with a mercury cup. Enough of the solvent is introduced into V to overflow into and partially fill the flask F. The apparatus is then exhausted to the desired degree through the tube fitted with the stopcock S, which is then closed. The condenser tube T is cooled by water circulating through the jacket C and the flask is warmed by heating over an electric plate or bulb. This results in continuous evaporation of the liquid in F and condensation in T, the condensed liquid rising in V and *t* until it overflows into F.

The advantages claimed for the apparatus are that it requires only a small amount of solvent, and that being operated at reduced pressure it is especially suitable for the extraction of labile substances which are destroyed either by oxidation or by high temperature.

An extremely sensitive color reaction for phosphates and arsenates, and its application, G. Denigès (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 17, pp. 802–804*).—The reagents employed in the test consist of an acid solution of ammonium molybdate prepared by mixing equal volumes of a 10 per cent solution of the salt and concentrated H_2SO_4, and a freshly prepared stannous chlorid solution obtained by treating 0.1 gm. of tinfoil with 2 cc. of pure HCl solution and 1 drop of 3 per cent $CuSO_4$ solution, heating until the tin dissolves, diluting to 10 cc., cooling, and decanting off the clear solution.

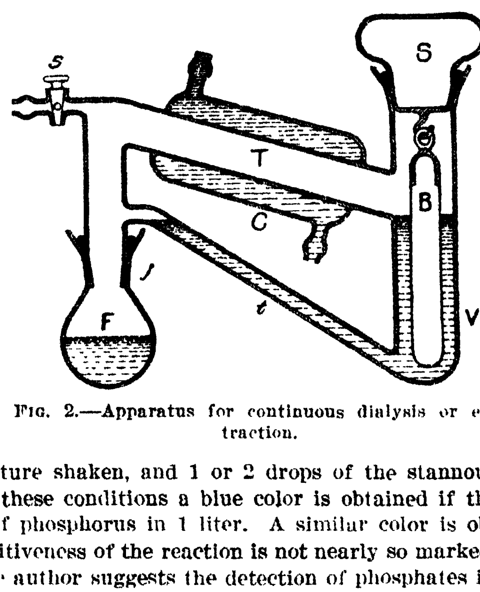

Fig. 2.—Apparatus for continuous dialysis or extraction.

In applying the test to liquids containing small amounts of phosphorus, from 3 to 10 drops of the molybdate solution is added to 5 cc. of the liquid to be tested, the mixture shaken, and 1 or 2 drops of the stannous chlorid solution added. Under these conditions a blue color is obtained if the solution contains about 1 mg. of phosphorus in 1 liter. A similar color is obtained with arsenic, but the sensitiveness of the reaction is not nearly so marked.

As applications of the test the author suggests the detection of phosphates in potable and other waters, soils, and rocks, and of phosphorus in very minute quantities in animal products such as blood, bile, spinal fluid, etc. One drop of blood dissolved in 5 cc. of water is said to give the test.

The determination of nitrates in soil, A. L. Whiting, T. E. Richmond, and W. R. Schoonover (*Jour. Indus. and Engin. Chem.*, *12* (*1920*), *No. 10, pp. 982–984*).—The method described, which is said to have been used with satisfactory results on thousands of soil samples representing varied conditions as to type and treatment, is a modification of the Devarda method, the essential features being the use of hydrochloric acid as the nitrate extractant and of sodium peroxid as the oxidizing agent. The technique is as follows:

"The water-free samples from moisture determinations are placed in 400 cc. shaker bottles, and 300 cc. of approximately 0.5 per cent hydrochloric acid is added. The mixture is then shaken in a mechanical shaker for from 1 to 3 hours and allowed to settle overnight. Five gm. of sodium peroxid is placed in an 800 cc. Kjeldahl flask. A 200 cc. aliquot part of the acid soil extract is blown off into a graduated flask, then poured on the peroxid, and the contents of the

flask boiled down to from 20 to 25 cc., or, if urea is present, to complete dryness. Two hundred cc. of nitrogen-free distilled water is now added, together with 0.5 gm. of Devarda's alloy (50 per cent aluminum, 45 per cent copper, and 5 per cent zinc), and the mixture distilled for 40 minutes, and collected in standard sulphuric acid. Sodium hydroxid of a strength such that 1 cc.=0.5 mg. of nitrogen is used for titration. Rosolic acid or methyl red is the best indicator. A table of titrations reading direct to pounds per 2,000,000 lbs. of wet soil avoids laborious calculations."

That the method determines only nitrate nitrogen was confirmed by precipitation of the nitrate in the soil extracts with nitron solution and analysis of the crystals of nitron nitrate and the filtrate from the same. Other reducing methods than the Devarda alloy were tested, but the only one that gave promise of being workable on a large variety of soils was the aluminum method, and this proved to be very slow in the presence of organic matter and possibly of potassium aluminate. As large amounts of copper were left from the Devarda alloy, it is suggested that an alloy containing less copper and more aluminum and zinc might prove as efficient and much less expensive.

The hygroscopic moisture of flour exposed to atmospheres of different relative humidity, C. H. Bailey (*Jour. Indus. and Engin. Chem., 12 (1920), No. 11, pp. 1102–1104, fig. 1*).—The author, with the cooperation of I. Everts, has made a study at the Minnesota Experiment Station of the moisture content of flour in atmospheres of different but constant humidity after a period of exposure sufficiently long to permit the hygroscopic moisture of the flour to reach equilibrium with the atmosphere. The humidity of the atmosphere was controlled by placing the flour in 5 gm. samples in flat-bottomed aluminum drying dishes in desiccators containing sulphuric acid solutions of such strength as to afford humidities of 30, 50, 70, and 80 per cent, respectively. The desiccators were kept in a thermostat for 8 days, when the dishes were removed, weighed, and replaced for an additional 2-day period, after which they were dried to constant weight at 100° C. in vacuo.

Samples of patent and clear flours showed no great differences in percentage of moisture, although the results with the patent grade were slightly higher. The hygroscopic moisture at 25° ranged from slightly more than 5 per cent at 30 per cent relative humidity to 15 per cent at 80 per cent relative humidity.

"Curves representing the relation between hygroscopic moisture (ordinates) and relative humidity (abscissae) have the shape of a simple parabola, thus indicating that hygroscopic moisture does not increase at a uniform rate when in equilibrium with an increasing atmospheric humidity.

"Flour testing laboratories engaged in analyzing fresh flour containing 12 to 13 per cent of moisture will experience no appreciable change in the moisture content of such flour if the relative humidity of the laboratory atmosphere is maintained in the neighborhood of 70 per cent."

Action of hydrogen peroxid on flours, Marion (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 17, pp. 804–806*).—The catalase content of a given amount of flour determined under carefully controlled conditions is thought to be a measure of the extent of the extraction or milling of the flour. The technique of the procedure and characteristic results with different flours are given.

A chemical method for the detection in fruit of a prior frozen condition, W. M. Dehn and M. C. Taylor (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 977–979*).—The method described, which makes use of the fact that freezing brings about a rapid transformation of sucrose to invert sugar, is essentially as follows:

One half of the fruit is analyzed directly, and the other half is frozen with cracked ice and salt and subsequently thawed and analyzed, the analyses in both cases consisting of the estimation by the gravimetric Fehling method of invert sugar before and after hydrolysis. If the fruit has not been previously frozen the percentage of inversion resulting from freezing, thawing, and autolysis to the time of analysis will be very much higher than if the fruit has been frozen. It is thought that this method will serve to indicate a prior frozen condition such as would obtain with too low temperatures in cold storage, provided too great deterioration of the fruit after removal from storage had not taken place.

Detection of tea oil in olive oil, E. MILLIAU (*Compt. Rend. Acad. Agr. France, 6 (1920), No. 23, pp. 578–581*).—Three methods of detecting tea oil in olive oil, an adulteration said to be quite common, are noted briefly.

The most delicate test consists in adding 4 cc. of the oil to a mixture of 5 cc. concentrated H_2SO_4, 3 cc. concentrated HNO_3, and 3 cc. of water. The tube is shaken for 30 seconds, plunged into water at 5° C. for 5 minutes, and then allowed to stand in water at 15° for 15 minutes. Under these conditions the acid layer is said to be colorless, while the oil is limpid and straw-colored if pure olive oil, black and opaque if pure tea oil, a deep dirty brown if a mixture of 90 per cent olive and 10 per cent tea oil, and a deep rather muddy straw color if a mixture of 95 per cent olive and 5 per cent tea oil.

The jelly strength of gelatins and glues, S. E. SHEPPARD, S. S. SWEET, and J. W. SCOTT, JR. (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 1007–1011, figs. 11*).—A torsion dynamometer for determining the jelly strength of gelatin and glues under pure shear of molded cylindrical test pieces is described and illustrated. The product of breaking load × twist, divided by the cross section of the test piece, is taken as the jelly strength. No simple relation was found to hold between the concentration of the gelatin and the jelly strength, or between the jelly strength at a given concentration and the glue-joint or tensile strength of a dry glue-joint.

A new technical method for the estimation of the saccharogenic power of diastatic preparations, K. OSHIMA (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 991–993*).—The author describes the Lintner method and the modified Ling method for the determination of the saccharogenic power of diastatic preparations, and outlines further modifications in technique which are said to render the method more accurate than the original method and less troublesome for routine factory work than the method used by Sherman and his associates.

The method consists essentially in digesting a mixture of 10 cc. of the extract or diluted extract and 100 cc. of 2 per cent soluble starch solution in a water bath at 40° C. for 30 minutes, at the end of which time 10 cc. of N/10 NaOH is added to stop further action. Graduated quantities of the digest are then poured into a series of test tubes, each containing 5 cc. of Fehling's solution, the tubes are placed in a boiling water bath for 10 minutes, and the smallest quantity of the digested starch solution which just reduces the Fehling's solution is determined. Tables are given showing the Lintner values corresponding to the exact values obtained by this method with different strength extracts of the diastase from *Aspergillus oryzæ* at 40 and at 50° and for malt diastase at 40°.

Rapid colorimetric methods for the determination of phosphorus in urine and blood, R. D. BELL and E. A. DOISY (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 55–67*).—Rapid colorimetric methods are described for the determination of inorganic, organic, and total phosphorus in urine and of inorganic and acid-soluble phosphorus in blood. These methods depend upon the fact that

certain reducing agents such as hydroquinone will reduce phosphomolybdic acid without effecting molybdic acid, and that consequently the molybdenum present as phosphomolybdic acid can be colorimetrically determined in the presence of an excess of molybdic acid, thus avoiding the necessity of isolating the ammonium phosphomolybdate.

The estimation of chlorids in blood, V. C. Myers and J. J. Short (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 47–53*).—A method of chlorid estimation in blood is described, in which the same picric acid filtrate employed for the estimation of sugar and creatinin and the same solutions (diluted) employed for the Volhard-Harvey estimation for chlorids in urine are utilized. Both the picric acid and the silver chlorid precipitates are removed by centrifugation instead of filtration. The technique is described in detail, and the results are reported of parallel determinations by the method described and the Austin-Van Slyke method (E. S. R., 42, p. 712), these results showing close agreement.

A clinical method for the determination of blood sugar in minute quantities of blood, I. S. Kleiner (*Jour. Amer. Med. Assoc., 76 (1921) No. 3, pp. 172, 173, figs. 3*).—The method is based on the Benedict procedure (E. S. R., 39, p. 112), modified for use with a new microcolorimeter developed by R. E. Klett. The instrument, an illustration of which is given, carries a vertically sliding eyepiece connected behind an intervening diaphragm with a round clip in which can be placed a standard graduated test tube containing the unknown solution. The standard color, a 2.5 per cent solution of potassium dichromate, is contained in a wedge made by grinding a test tube and fusing it to a ground glass plate. Slits in the diaphragm in front of the color wedge and the tube of unknown solution enable the observer to compare the two colors and, by moving the eyepiece up and down, to obtain an exact match. The technique of the determination is described in detail, and tables are given from which the percentages of sugar can be estimated from the scale reading.

Note on the preservation of specimens of blood intended for blood sugar determinations, W. Denis and M. Aldrich (*Jour. Biol. Chem., 44 (1920), No. 1, pp. 203–206*).—Formaldehyde in the proportion of 1 drop ($\frac{1}{30}$ cc. of commercial formalin to 5 cc. of oxalated blood has been found to be a suitable preservative for blood samples intended for sugar determinations. Experimental results have shown that by the use of this small amount of formaldehyde glycolysis can be prevented in blood samples for as long as 96 hours at temperatures varying from 20 to 30° C. It is thought that samples thus preserved can also be used for the determination of creatinin and uric acid, but the results for nonprotein nitrogen and urea are invariably low.

The determination of moisture in beet sugar factory products, V. L. Aikin (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 979–981; also in La. Planter, 65 (1920), No. 17, pp. 266–268*).—Following a study of the effect of various factors on the determination of moisture in saccharin products such as molasses, the following technique is recommended as giving the best results:

"Use only sand that will pass a screen with 0.25 mm. perforations; digest the sand in hot hydrochloric acid, wash, and ignite. Use 25 to 30 gm. of sand, and dry and weigh just previous to making the determination. Weigh into the dish not over 1 gm. of dry substance, add 1 cc. of water, place the dish on top of a dry oven until warm, mix for 3 minutes, and warm and mix again, until a perfectly homogeneous mixture is obtained. Dry at a temperature of 105° C. for 6 hours, cool, and weigh. Repeat until the loss in weight after heating for a period of 1 hour is less than 0.1 per cent.

"Make all weighings as soon as the temperature of the desiccator is within 2° of the temperature of the balance. Repeat all determinations where the duplicates do not check within 0.2 per cent."

Changes in the polarizing constants of sugars during refining, A. F. Blake (*Jour. Indus. and Engin. Chem.*, *12* (*1920*), *No. 11, pp. 1104–1107*).—Attention is called to the fact that the percentage of true sucrose in a mixture of sucrose and pure invert sugar consisting of equal parts of dextrose and levulose will exceed the polarization at 20° C. by about three-tenths of the percentage of invert sugar. If S represents the percentage of sucrose, P the polarization, and I the percentage of invert sugar, a value of (S—P)/I above 0.3 indicates excess of levulose and below 0.3 excess of dextrose. This paper reports the results of an attempt to determine the cause of the low values of this ratio often found in refined sugar.

Analyses of the products obtained in the various steps of the process of refining a lot of Cuban raw sugar of known initial composition are reported, which indicate two causes of the changes in polarization constants during refining, (1) a slight destruction of levulose by the action of heat and lime, and (2) the absorption of levulose in excess of dextrose by bone black.

The attention of sugar refiners is called to the fact that losses of sucrose on refining, figured on Clerget tests, will exceed those figured from polarizations, as the inversion during refining naturally tends to balance invert losses. It is also pointed out that statements based on polarization are particularly optimistic as regards sucrose losses when the raw sugars have high values for (S—P)/I, as the final value of this ratio tends to be about the same regardless of the raw sugar used.

Bone black and decolorizing carbons, W. D. Horne (*Jour. Indus. and Engin. Chem.*, *12* (*1920*), *No. 10, pp. 1015–1017*).—In this paper the author discusses the desirable and undesirable features of various decolorizing and purifying agents for use in sugar refineries and factories.

Occurrence of diastase in the sweet potato in relation to the preparation of sweet potato sirup, H. C. Gore (*Jour. Biol. Chem.*, *44* (*1920*), *No. 1, pp. 19, 20*).—Studies at the Bureau of Chemistry, U. S. Department of Agriculture, on the production of sirup from sweet potatoes have shown that the sweet potato is so rich in diastase that sirup can readily be made from it without the use of malt. The method consists in heating the potatoes in water at a temperature of maximum diastatic activity (from 60 to 80° C.) for from 10 to 20 minutes, then heating to boiling to soften the tissues, crushing, separating the juice from the pulp, and evaporating the juice to sirup. The diastatic power of extracts of sweet potato and sweet-potato flour was found to range from 160 to 300° Lintner.

Orange vinegar by rapid process, E. M. Chace and H. D. Poore (*Citrus Indus.*, *1* (*1920*), *No. 7, pp. 12, 13, 17, 18; also in Fla. Grower*, *22* (*1920*), *No. 4, pp. 4, 5, fig. 1; Calif. Citrogr.*, *5* (*1920*), *No. 9, pp. 282, 296, 297, figs. 2*).—The authors describe a process for making orange vinegar in generators having capacities ranging from 30 to 150 gal. every 24 hours.

The generators consist of upright fir tanks provided with three compartments, the upper one containing the distributing system, the center beechwood shavings, and the third the finished product. The distributing system consists of a trough divided lengthwise into two compartments so hinged as to their base that one empties into the middle compartment through a perforated bottom while the other is being filled. The central compartment, which is also provided with a perforated floor, is loosely filled with beechwood shavings. An aperture in the middle is fitted with a thermometer which reaches to the center of the compartment. Just below the floor of this compartment are six 1-inch holes slanting down through the wall of the generator. These are provided with wooden pegs by means of which the volume of air passing

through the generator can be regulated and the temperature controlled as nearly as possible at 86° F.

In operation the beechwood shavings are first saturated with a good quality of nonpasteurized cider vinegar. Orange cider prepared by fermentation with yeast is allowed to run in slowly, the temperature being closely watched. In large generators under carefully controlled conditions the cider is converted into vinegar by one passage, while in smaller ones it is customary to run the product through a second generator.

In general the product exceeds the standard for total acidity of cider vinegar, owing to the nonvolatile acids of the original juice. From the cost of equipment and operation of an orange vinegar plant, it is estimated that the vinegar produced could not compete with bulk cider vinegar, but if properly and attractively bottled might compete favorably with the best selling brands of bottled vinegar.

Orange vinegar: Its manufacture and composition, H. D. POORE (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, pp. 1176–1179, fig. 1*).—This paper, in addition to a description of the generator process for making orange vinegar noted above, describes briefly the home or barrel method of making the vinegar on a small scale and gives the full report of experimental work conducted with the generator process on five different lots of oranges, two of them sound fruit and three frozen. Analyses are given of the vinegars made by both the barrel and the generator process.

Proceedings of the thirty-third annual convention of the Association of Official Agricultural Chemists, 1916 (*Jour. Assoc. Off. Agr. Chem., 3 (1920), Nos. 3, pp. IV+279–425, figs. 3; 4, pp. V+427–612*).—This is a detailed report of the convention held at Washington, D. C., November 20–22, 1915. A general report of these meetings has been previously noted (E. S. R., 36, p. 298).

METEOROLOGY.

The status and problems of meteorology, C. F. MARVIN (*Natl. Acad. Sci. Proc., 6 (1920), No. 10, pp. 561–572*).—This is essentially an outline of the organization and principal activities of the Weather Bureau, U. S. Department of Agriculture, bringing out especially the numerous points of contact between the work of such a service and the public welfare, including the many ways in which it bears on agriculture, and setting forth some of the needs and problems of meteorology as exemplified in the work of the bureau.

The interests of agriculture are served particularly by "information relative to the effect of current weather conditions on farm activities, the growth of vegetation, and the development of crops and their advancement as compared with an average season," by dissemination of advice and information relating to the utilization of the special forecasts and warnings issued by the bureau in the interest of various lines of agriculture, horticulture, and stock raising, and through investigations on the relationship between weather conditions at various periods of the growing season and crop yields.

It is shown that "to-day there is scarcely any important industry or activity of the nation which is not to a greater or less extent influenced by weather conditions, and therefore needs the advices, information, and economic benefits which flow from the full and efficient administration of all its duties."

Among the outstanding problems of meteorology noted are the need for more attention to systematic instruction in the subject, for laboratory work in meteorology, and for the development of work in meteorology of the oceans and in aerology.

Physics of the air, W. J. HUMPHREYS (*Philadelphia: J. B. Lippincott Co., 1920, pp. XI+665, pls. 2, figs. 199*).—This book is the outcome of an attempt at an orderly assemblage of the widely scattered facts and theories relating to the physical phenomena of the earth's atmosphere, which began with a course of lectures at the San Diego Aviation School in 1914, followed by the serial publication of articles on the subject in the *Journal of the Franklin Institute* during 1917–1920. These articles, previously noted (E. S. R., 39, p. 616), are here reprinted in revised form. The book consists of four parts as follows: I, mechanics and thermodynamics of the atmosphere; II, atmospheric electricity and auroras; III, atmospheric optics; IV, factors of climatic control.

Part I contains chapters on observations, some theoretical temperature relations of the atmosphere, observed vertical temperature gradients, the isothermal region or stratosphere, composition of the atmosphere, insolation, atmospheric circulation, winds adverse to aviation, barometric fluctuations, evaporation and condensation, fogs and clouds, the thunderstorm, and lightning. Part II deals with atmospheric electricity and aurora polaris. Part III includes chapters on perspective phenomena; refraction phenomena—atmospheric refraction, refraction by water drops, and refraction by ice crystals; reflection phenomena; diffraction phenomena; and phenomena due to scattering--color of the sky, and sky polarization. Part IV contains chapters on a general summary; principal ice-age theories; vulcanism—theory, and observational; and other factors of climatic control.

Variation in nocturnal radiation during calm nights, A. BOUTARIC (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 23, pp. 1165–1167; abs. in Rev. Sci. [Paris], 58 (1920), No. 24, p. 752*).—Results obtained at the Pic du Midi observatory, from August 11 to 24, 1919, confirm those recorded at Montpellier in showing that, contrary to the observations of Lo Surdo at Naples and of Exner at Sonnblick, the intensity of nocturnal radiation during calm nights generally reaches a maximum a little after sunset and decreases slowly and regularly until morning.

The effect of weather changes on soil temperatures, T. B. FRANKLIN (*Roy. Soc. Edinb. Proc., 40 (1919–20), No. 1, pp. 56–79, fig. 1*).—This paper is based on records of hourly values taken during the day and on selected nights during 1919, using the ratio of the ranges of temperature at the depth of 4 in. in the soil and at the surface $\left(\frac{R_4}{R_0}\right)$ as the standard. Various agencies causing fluctuations in the underground temperature are dealt with in detail, namely, sunshine and shade, rain, character of soil and seasonal changes in conductivity, heat transfer in the soil, wind and relative humidity, frost, snow, the advance of spring, and long-period weather changes.

The conclusions are that "(1) the values of $\frac{R_4}{R_0}$ have a wide range of variation, from 0.19 in very dry soil to 0.85 during heavy rain; the most common value is about 0.4. The monthly mean values showed a decided connection between $\frac{R_4}{R_0}$ and the frequency of rainfall; in fact, percolation of rain seems to be the dominating factor in deciding the value of $\frac{R_4}{R_0}$. This is also borne out by the different values of $\frac{R_4}{R_0}$ in various soils according to their behavior with regard to water; in sand the values change with mercurial rapidity, due to the easy percolation of rain and subsequent rapid drying,

while in clay they change but sluggishly, since clay takes up and parts with water with difficulty. (2) In view of the fact that the values of $\frac{R_4}{R_0}$, and therefore the values of the diffusivity of the soil are so dependent on the percolation of rain, it is possible that the values commonly given for the diffusivity of the surface layers of the earth need revision. (3) Underground temperatures are also considerably affected by (*a*) strong winds of low relative humidity, (*b*) the frequency and intensity of frost when the soil has no snow covering, (*c*) the depth of snow, (*d*) weather changes of long period. (4) The date of flowering of coltsfoot appears to bear little relation to the monthly mean values of temperature, but is closely related to the number of frosts on open soil not covered with deep snow. It is possible that good results would be obtained by comparing the phenological returns of the last 30 years with the accumulated temperature underground above the growing temperature for each plant considered."

The penetration of frost in the soil, V. Engelhardt (*Met. Ztschr.* [*Brunswick*], *37* (*1920*), *No. 11, pp. 305–312*).—This is an analysis of data bearing upon the rate, depth, and modifying conditions of frost penetration. The mathematical treatment of the subject by Neumann, Stefan, and Schreiber is also discussed.

Periodicity of winter temperatures in western Europe since A. D. 760, C. Easton (*K. Akad. Wetensch. Amsterdam, Proc. Sect. Sci., 20* (*1918*), *pt. 2, pp. 1092–1107, pl. 1*).—Data for the period 760 to 1916 are analyzed for 22¼, 44½, and 89-year periods.

A general conclusion is that "increased and accelerated activity of the solar surface corresponds in general to the winter cold in western Europe setting in more forcibly and rapidly than usual; inversely a weakened and retarded activity of the sun corresponds to winters setting in later and more mildly in a later part of the period." Another conclusion is that all temperature averages since 1852 are higher than the true mean. Apparently only an 89-year series gives a true average.

The influence of forests on climate, T. Wlissidis (*Centbl. Gesam. Forstw.*, *44* (*1918*), *No. 3–4, pp. 94–99*).—Reviewing briefly the observations and investigations on this subject, the author concludes that there is almost always a small difference between the climatic elements of forests and of the free air, but that forests have a wider beneficial influence on the climate than is shown by the measurement of differences in the climatic elements.

Carbonic acid and plant growth, F. Bornemann (*Kohlensäure und Pflanzenwachstum. Berlin: Paul Parey, 1920, pp. VI+110, figs. 11*).—This is a review of investigations, including those of the author, bearing on the relation of carbon dioxid to plant growth and on the conditions of culture and fertilization which determine the carbon dioxid content of the soil and air surrounding plants. The general conclusion is that notwithstanding the inexhaustible supply of carbon dioxid in the atmosphere there is ordinarily not enough of this gas in the plant environment for maximum growth, hence the importance of adopting methods of fertilizing or other means that will increase the supply of carbon dioxid available for plant use.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 7* (*1920*), *Nos. 7, pp.* [*201*], *pls. 4, fig. 1; 8, pp.* [*201*], *pls. 4, fig. 1*).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for July and August, 1920, respectively.

SOILS—FERTILIZERS.

Chemical composition of some Louisiana soils as related to soil series and to texture, S. S. WALKER (*Louisiana Stas. Bul. 177 (1920), pp. 27, figs. 4*).—Chemical analyses of 67 soils and 64 subsoils, distributed among 8 soil series and 27 soil types from the Longleaf Pine Belt area in Louisiana, are presented and discussed, with the purpose of discovering similarities or differences which may exist between soil series and also between classes of soils grouped on the basis of texture.

It was found that there are usually wider variations within a given series or class than there are between the averages of series or classes. In general, the analyses indicate that chemical composition bears a closer relationship to a series system of grouping than to a system based on the soil texture only. Certain relationships between the various soil constituents and between soil and subsoil are indicated.

Soil Survey of Pearl River County, Miss., E. M. JONES and G. W. MUSGRAVE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 38, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the State of Mississippi, deals with the soils of an area of 510,080 acres in extreme southern Mississippi, which lies entirely within the Gulf Coastal Plain. The topography in general is rolling to flat. Drainage outside the flat areas is well established, and it is stated that the flat areas could be easily drained.

The soils of the area are of residual and alluvial origin. Including swamp, 21 soil types of 12 series are mapped, of which the Ruston and Susquehanna fine sandy loams cover 46.5 and 11.4 per cent of the area, respectively.

The soil resources of Nebraska, G. E. CONDRA (*Nebr. Univ., Nebr. Conserv. and Soil Survey Bul. 15 (1920), pp. 76, figs. 27*).—This is a brief general report on the soils of Nebraska, in which the State is divided into three distinct regions on the basis of soil, topography, and economic development as the loess, sand hill, and high plains regions.

The loess region occupies a little more than the southeast half of the State and is divided into loess plains, rough land areas, wind-formed hill areas, drift hills, bench lands, and alluvial plains. The sand-hill region embraces a large area in the northwest-central part of the State and smaller outlying areas. This region is a vast prairie and covers about 18,000 square miles. The leading divisions of the sand-hill region are the dunesand, dry valley soils, and wet valley soils. The high-plains region occupies between 15,000 and 16,000 square miles of the western and northern parts of the State, and is characterized by table-lands or plains.

General information on soil conservation in these areas is also given.

Soil survey of Rock County, Wis., W. J. GEIB ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 51, fig. 1, map 1*).—This survey, made in cooperation with the Wisconsin Geological and Natural History Survey and the University of Wisconsin, deals with the soils of an area of 458,240 acres in extreme southern Wisconsin. The topography of the area ranges from level or gently undulating in the prairie and filled valley sections to hilly and broken in the rougher parts. All parts of the region are said to be reached by drainage ways.

The soils of the county are derived from glacial drift, from the underlying rock formations, from water-laid materials, and from decaying vegetation. Including peat, 26 soil types of 11 series are mapped, of which the Carrington, Miami, Waukesha, and Clyde silt loams cover 19.1, 18.8, 13.7, and 11.5 per cent of the area, respectively.

Composition of the soils of the French Antilles with reference to the fertility of coconut soils, M. RIGOTARD (*Agron. Colon., 5 (1920), No. 35, pp. 140–146*).—Analyses of nine samples of soils and subsoils of the French Antilles, upon which coconut trees are grown, showed that the potash content increased with the productivity. The opinion is expressed that the potash content is an indication of the relative fertility of coconut soils. The nitrogen content of these soils decreased as the productivity increased. The content of phosphoric acid soluble in 2 per cent citric acid was relatively low, but apparently increased somewhat as the productivity increased. The most productive soils were found to contain considerable coarse sand, resulting in high permeability.

Effect of season and crop growth on the physical state of the soil, D. R. HOAGLAND and J. C. MARTIN (*Jour. Agr. Research [U. S.], 20 (1920), No. 5, pp. 397–404, figs. 4*).—Studies conducted at the California Experiment Station on the effect of season and crop growth on the physical condition of cropped and uncropped soils kept at approximately optimum moisture content are reported. Conductivity measurements were also made on water extracts of the soils to study the changes in the water-soluble constituents.

The results indicated that a very good general correlation exists between the quantity of soluble constituents in soil and the quantity of suspended material, and that in both cases the magnitudes undergo very marked variations coincidently with seasonal changes and crop growth. The fluctuations were, however, much more pronounced in the cropped than in the uncropped soils.

Chemical analyses, conductivity measurements of water extracts, and freezing-point depressions of moist soil all indicated that the uncropped soil yielded a soil solution of higher concentration than that of the cropped soil. A comparison of a sample of soil which had been stored for several years in a slightly moist condition with a sample of the same soil cropped for several years showed that the two soils contained widely different concentrations of electrolytes, and turbidity measurements indicated that 20 times as much material was kept in suspension in the cropped soil.

The general conclusion is drawn that "the physical state of certain soil constituents is influenced to a marked degree by the concentration of the soil solution. The colloidal state of the soil suspension undergoes significant alterations during the season. A large increase in colloidal matter is noted when the soil solution is depleted as a result of absorption of solutes by the plant."

Recent investigations on soil ventilation, A. HOWARD (*Bol. Agr. [Portuguese East Indies], 1 (1919), No. 3–4, pp. 254–264, figs. 4*).—A number of experiments conducted in India on soil ventilation are reviewed to show that it is an important factor, affecting crop growth, soil structure, and the quality of crops.

The Mangum terrace, E. W. LEHMANN and F. L. DULEY (*Missouri Sta. Circ. 98 (1920), pp. 8, figs. 6*).—Popular information is given on the planning and construction of the Mangum terrace, with particular reference to practice in Missouri.

Degree of temperature to which soils can be cooled without freezing, G. BOUYOUCOS (*Jour. Agr. Research [U. S.], 20 (1920), No. 4, pp. 267–269*).—In a contribution from the Michigan Experiment Station, experiments with 16 different soils and 5 different artificially prepared materials to determine the amount of cooling which they will withstand without freezing are reported.

The soils varied from sand through loam and clay to peat and muck. The results showed that mineral soils may be cooled to —4.2° C. (24.44° F.) and peats and mucks to —5° without freezing. The conclusion is drawn, therefore, that during mild winters and in mild climates in the winter the soils may not freeze even though they are cooled below their freezing point. No expla-

nation is offered for the fact that soils withstand a smaller degree of supercooling than the artificial materials.

It is further concluded that the method now in vogue for measuring temperature in soils in cold seasons may not give entirely the true facts. Since water in the liquid state has twice the specific heat of ice, it is also pointed out that as long as the soil moisture remains in the liquid state the temperature fluctuations in the soils will be correspondingly slower and smaller.

"The ability of soils to resist freezing even when their temperature is much below the freezing point throws considerable new light on questions regarding the temperature of soils in cold seasons and consequently upon the physical, chemical, and bacteriological processes going on in the soils during those seasons."

Relation of the soil solution to the soil extract, D. R. HOAGLAND, J. C. MARTIN, and G. R. STEWART (*Jour. Agr. Research* [*U. S.*], *20* (*1920*), *No. 5, pp. 381–395, figs. 2*).—In a contribution from the California Experiment Station, seasonal studies from original and other sources on cropped and uncropped soils are described, which showed that water extracts reflect the principal fluctuations taking place in the soil solution as indicated by the freezing point method.

It is pointed out that "a soil extract is composed chiefly of the solutes present in the soil solution, plus substances dissolved from 'adsorbed' or easily soluble components of the soil. This latter fraction of the soil extract is dependent in part on the concentration and composition of the soil solution, since the solutes of the latter exert a depressing effect on the solubility of certain soil constituents." This fact is believed to be of great importance in studies of chemical equilibria in soils.

A new method is suggested for indicating the relations between the chemical elements in the soil solution. Extracts were prepared which did not change appreciably in composition or concentration on contact with the soil. "The consideration of the equilibria involved suggests the probability that the ratios between most of the important elements are very similar in concentrated soil extracts and in the soil solution." It is concluded that analyses of suitable soil extracts and determinations of freezing-point depressions may frequently permit a calculation of the concentration and approximate composition of the soil solution.

The data relating to the making of water extracts of soils suggest that in seasonal studies extracts should be made with the smallest proportion of water to soil practicable and with the time of contact limited to that necessary for thorough admixture. In routine work 1:1 or 1:5 extracts are considered convenient and satisfactory. Previous conclusions that the soil solution fluctuates in composition and concentration with every environmental change and with crop growth are also confirmed.

The hydrogen-ion concentration of certain three-salt nutrient solutions for plants, A. G. MCCALL and J. R. HAAG (*Soil Sci.*, *10* (*1920*), *No. 6, pp. 481–485, fig. 1*).—Experiments conducted at the Maryland Experiment Station on the hydrogen-ion concentration of nutrient solutions used in soils and plant nutrition studies showed that, in general, with any one type the hydrogen-ion concentration of the solution is a function of the volume-molecular proportion of the di-hydrogen phosphate salt present. The types containing potassium phosphate had a lower hydrogen-ion concentration than those containing either magnesium or calcium phosphate. The sulphates and the nitrates apparently were of only minor influence in determining the reaction of the nutrient solution.

It is concluded that the variations in plant growth within any one type of solution can not be correlated with differences in the hydrogen-ion concentrations of the solutions.

Morphological and physiological study on mycobacteria from soils, K. Vierling (*Centbl. Bakt.* [etc.], *2. Abt., 52 (1920), No. 9–12, pp. 193–214, pl. 1*).—Studies on the morphology and physiology of some 23 strains of mycobacteria isolated mainly from cultivated loam soils well supplied with humus, and on their influence on the growth of plants, are reported. Some of the strains were found to reduce nitrates in both liquid and solid media. It is concluded that the main activity of the mycobacteria is the decomposition and reduction of organized substances. They were found to utilize lime nitrogen as a source of nitrogen, and this is taken to indicate that they partake in the decomposition of this artificial fertilizer in soil. It was also found that they increased rapidly in humus soils.

Soil biology, C. M. Hutchinson (*Agr. Research Inst. Pusa Sci. Rpts., 1918–19, pp. 106–110*).—Field and plat observations of seasonal variation in nitrification in soils under crop and fallow showed that movement of soil water either upward or downward increased nitrate formation. In studies on the different rates of nitrification of various organic materials in soils, including green manures and oil cakes, the nonnitrogenous portions had an inhibiting action on the nitrification of the nitrogenous fractions.

Experiments on the inhibition of nitrification by toxins, resulting from anaerobic incubation of soils, showed that nitrification did not begin for 10 weeks in nutritive solution made up of water extract of anaerobically incubated soil, while nitrification was complete in 8 weeks in a similar solution made from aerobically incubated soil. Similar results were obtained when using pure cultures of nitrifying organisms seeded into these media.

Tests of the influence of nitrogenous matter on nitrification in various soils showed that 60 mg. of nitrogen per 100 gm. of soil was the maximum amount allowing complete and normal nitrification when added either as ammonium sulphate or as oil cake. When added as a mixture of these two, however, it was possible to raise the combined amount to 90 mg.

General information on nitrogen fixation studies is also given.

The relation of nitrates to nodule production, W. H. Strowd (*Soil Sci., 10 (1920), No. 5, pp. 343–356*).—Experiments conducted at the University of Wisconsin are reported, in which it was attempted to explain the deleterious effects of large amounts of nitrates in the soil on nodule formation. Comparative studies were made of the sap from plants differently treated.

It was found that when soy beans are grown in soil or in sand containing nitrates there is a marked accumulation of nitrates in the plant, the concentration being greater than in the soil or in the soil solution. Nitrates were found to have little effect upon the hydrogen-ion concentration of the plant juice. The concentration of nitrate present in plant sap when the plants failed to produce nodules was sufficient to practically prevent growth and reproduction of soy bean bacteria in soil. On the other hand, the concentration of the nitrate in the soil in which the plants were grown was so low that growth and reproduction in soil were stimulated. It is concluded that the reason for failure of nodule production in the presence of nitrates is due in part at least to the effect of the high concentration of nitrate in the sap upon the growth and reproduction of the bacterium of *Rhizobium leguminosarum*.

The origin of nitrates and nitrites in moor soils, T. Arnd (*Landw. Jahrb., 51 (1918), pp. 297–328*).—The author reviews the work of others bearing on the subject and reports studies from which he concludes that there are no grounds

for the assumption that, in addition to the well-known biological methods, nitrates are formed, especially in moor soils, by methods which may be explained on purely chemical bases. All occurrences relating to the formation of nitrates in moor soils are considered to be solely of biological origin, and the present views regarding the activities of nitrite and nitrate-forming bacteria need no changing or enlarging.

Peat deposits in the United States and their classification, A. P. Dachnowski (*Soil Sci., 10 (1920), No. 6, pp. 453–465*).—This paper, a contribution from the Bureau of Plant Industry of the U. S. Department of Agriculture, discusses the general characteristics of peat deposits in the United States, and gives information on their proper classification.

It is pointed out that in the utilization of peat deposits for one or more practical purposes the field conditions and the layers of peat material are controlling factors. Systems of classifying peat deposits, based on surface vegetation, topography, chemical analyses, and stratigraphy, are discussed, it being concluded that for the detailed study of American peat deposits correlation by plant remains is the most reliable working method.

Agricultural value of Indiana peat and necessary fertilizers, S. D. Conner (*Jour. Amer. Peat Soc., 13 (1920), No. 1, pp. 13–17*).—In a contribution from the Purdue Experiment Station, it is stated that Indiana contains several hundred thousand acres of peat and muck soils, which may be classed agriculturally as those well supplied with lime and those deficient in lime. Probably four-fifths of the peat and muck soils of the State are of the nonacid type, which is mainly deficient in potash and to a much less degree in phosphoric acid. The very acid types of peat soil require liming and treatment with phosphate, potash being a minor need. The first step in the reclamation of peat soils is proper drainage, but it has been found that they should not be excessively drained, as they become too dry and crack. A depth of from 30 to 50 in. to the water table has been found satisfactory. The vegetation growing upon peat soil is considered to be a certain indication of its type.

The development of marsh soils in Wisconsin, A. R. Whitson (*Jour. Amer. Peat Soc., 13 (1920), No. 3, pp. 314–318*).—In a contribution from the University of Wisconsin, studies extending over a period of several years of the peat and marsh soils of the State are reviewed.

It was found that the acid peat soils in the sandstone section of the northeastern part of the State need phosphorus even more than potash. Further studies on raw peat underlaid by clay in the northern part of the State and in the sandstone district of the central part demonstrated the absolute necessity for the use of mineral fertilizers. The peat soils in the limestone section are nonacid and require only potash fertilization.

Studies of the relation of peat land to frost showed that the condition of the soil greatly affects the formation of frost. The temperature immediately above the surface of poorly drained peat land was found to fall considerably lower than that over well-drained sanded marsh on cold nights.

It is considered evident that most of the marsh land that can be drained may be successfully developed for agriculture.

Chemical requirements of peat soils in the light of European experience, F. J. Alway (*Jour. Amer. Peat Soc., 13 (1920), No. 3, pp. 327–341*).—A review of the methods employed in the treatment of peat soils in different countries of Europe is given, together with information on the establishment and operation of the more important peat experiment stations, particularly in Germany, Holland, and the Scandinavian countries. In this connection attention is drawn to the importance of differentiating between initial chemical requirements and

later chemical requirements of peat soils. All of the methods used have in common the installation of satisfactory drainage as a first step.

Peat soils are classified on the basis of European experiments into two main groups, as low-lime and high-lime peats. The low-lime peats need lime, potash, and phosphoric acid, and also nitrogen where inoculated legumes are not grown. The high-lime peats are subdivided into (1) those infrequent types which are productive without fertilization, (2) those types needing potash only, which are very rare and confined to soils with an especially high content of phosphoric acid, (3) these types needing only phosphoric acid at first, which are very rare in Germany, more frequent in Sweden, and not uncommon in some parts of Russia, and (4) those types needing both potash and phosphoric acid when first brought under cultivation, as well as in later years. These are by far the most common.

A list of references to literature on the subject is appended.

A phosphate-hungry peat soil, F. J. Alway (*Jour. Amer. Peat Soc., 13 (1920), No. 2, pp. 108–143, figs. 21*).—Experiments conducted by the Minnesota Experiment Station on the crop-producing capacity and fertilizer requirements of a peat soil deficient in phosphoric acid but apparently well supplied with potash are reported.

The experiments were conducted on burned and unburned peat. The burning varied from 9 to 18 in. in depth, averaging about 12 in. No commercial fertilizer was added to these soils, although some plats were manured. The unburned soils were cultivated and treated with potash and phosphate singly and combined, manure alone, manure reinforced with phosphate, and manure reinforced with both phosphate and potash. Sixteen different crops were grown on $\frac{1}{40}$ and $\frac{1}{80}$ acre plats.

From the results of the first year of study, it is concluded that the supplies of lime and available nitrogen in this soil are abundant for the production of all crops suitable for the part of the State in which the plats are located, and that the potash supply is fully equal to the needs of the first year and perhaps of the first few years. The phosphoric acid supply was found to be so deficient that satisfactory yields of no crop except flax were obtained without adding this constituent in the form of either acid phosphate or manure. When either of these were added as large yields were obtained as when the two were added together. A heavy burning of the peat resulted in heavy yields of most crops, whether all the peat or only part of it had been burned off.

It is concluded that owners of such land may use farm manure, acid phosphate, or burning to increase the productiveness of these soils. The extent to which the first may be used depends upon the amount of stock kept and the last upon the weather and general drainage conditions, while the second can be employed to any desired extent and in any season. It is considered very uncertain how long the use of phosphate without potash will permit the profitable farming of these naturally unproductive soils. It is recommended that the reclamation of these soils be limited during the first season to work on an experimental scale.

"Burning the surface layer, which in some cases is desirable and which at times is very profitable, should be employed only after a careful consideration of the local conditions. Burning may ruin the drainage system, produce an alkali soil, leave a bowlder field, or, in the case of shallow peats, leave too little organic matter. The crop results in the first season after burning are usually excellent, but the beneficial effect either disappears the first season or gradually and rapidly becomes less, unless the peat layer be shallow and underlaid by a good mineral soil."

Pyrites and its toxic oxidation products in peat soils, C. O. Rost (*Jour. Amer. Peat Soc., 13 (1920), No. 3, pp. 303–306*).—Analyses of peat soils from different parts of Minnesota, made by the Minnesota Experiment Station, to determine the presence of iron sulphid and its toxic oxidation products, are briefly reported and discussed.

It is stated that in the peat bogs so far examined the maximum amount of sulphid has been found in the peat layer immediately above the muck. Representative areas of shallow peat in both the northeastern and northwestern parts of the State were examined. In the former only one occurrence of sulphid was found, while in the latter locality sulphids were found everywhere in the lowermost portion of the peat layer, but in only comparatively limited quantities. Tests showed that only a few feet back from the banks of the drainage ditches oxidation, with the consequent formation of ferrous sulphate and sulphuric acid, had not progressed far enough to be of any serious consequence.

"In some excavations on properly fertilized plats the live plant roots of crop plants were found penetrating through the lowermost peat layer, the muck layer, and some distance into the deeper subsoil. So it is only in connection with material thrown up in ditching that the oxidation of the sulphid might be rapid and extensive enough to produce a sufficient amount of ferrous sulphate and sulphuric acid to be injurious to growing plants. However, even then this material is in practice unavoidably mixed with the highly calcareous mineral substratum, so that any toxic substances formed would quickly be neutralized."

The use of peat as a fertilizer in Michigan, E. Levin (*Jour. Amer. Peat Soc., 13 (1920), No. 3, pp. 319–327*).—In a contribution from the Michigan Agricultural College, a summary of experience of a number of Michigan farmers on the use of peat alone and composted with manure as a fertilizer, as compared with the use of manure alone, is given.

It was found that peat in an advanced stage of decomposition is more likely to give satisfactory results when applied alone to soil than less decomposed peat. Peat applied alone to acid soil was of little value, but sometimes gave good results on the same soil when limed. Composting equal quantities of peat and manure gave excellent results, which were usually greater than those obtained with manure alone. The less decomposed peat required a longer composting with manure. In several cases peat alone depressed crop yields, while the same peat composted with manure gave as good results as the manure alone.

A few comparisons of peat with straw as a litter showed the peat manure to be equal to the straw manure in fertilizing value. Peat was found to be a better absorbent as a litter than straw.

The utilization of upland moor peat for fertilizer by the guanol process, A. Gehring (*Mitt. Ver. Förd. Moorkult. Deut. Reiche, 38 (1920), No. 11, pp. 239–246, fig. 1*).—The author summarizes the results of his own studies and those of others on the fertilizing action of guanol manufactured from upland moor peat and molasses.

It is concluded that one of the more important fertilizing functions of guanol is the production of carbon dioxid from the fermentation of the molasses. While the peat is usually considered to be merely a carrier for the molasses, there is evidence to indicate that the fermentation of the mixture has a tendency to decompose the peat so that it is more readily attacked by the soil bacteria, resulting in the liberation of its fertilizing constituents.

The extensive unlocking of raw phosphates by guanol is considered to be more or less doubtful, although it is conceded that sufficient acids may be formed

through the fermentation of the sugar in the molasses to accomplish a certain amount of this, provided there is not too much basic material present in the soil to prevent it. However, the fact that potash is usually used in the manufacture of guanol would seem to cast doubt on such action.

The author believes that upland moor peat should be used for guanol manufacture rather than lowland and moor peat, since the latter has a greater potential agricultural value.

A critical study of fertilizer experiments, C. B. LIPMAN and G. A. LINHART (*Natl. Acad. Sci. Proc.*, *6* (*1920*), *No. 11*, *pp. 684–686*).—In a contribution from the University of California, a brief statement is given of the more important findings from a statistical study of the results of the long-time fertilizer experiments at the Ohio and Pennsylvania experiment stations.

In this work the experimental plats were grouped in different ways, and included all check plats for each year, one check plat for all the years, one-element fertilizer plats for one year, and one, two, and three element fertilizer plats for all the years. It is pointed out that the one-element fertilizer treatments show no significant increases in yield over those obtained from the check plats. The two-element fertilizer plats are said to show definite increases in yield over the controls, and the three-element plats show increases over the control and two-element plats. The question of profit in these yields is as yet undetermined. The kind and amount of fertilizer used seem to have been without significance.

"Even when fertilizer experiments are properly planned and the results adequately studied by statistical methods, our present knowledge of the enormous variability of all soils and plants renders the data from any given fertilizer plat of value only on that plat, no matter how near the experimental one. This important consideration renders it highly probable that no fertilizer experiment as ordinarily conducted is possessed of sufficient practical value to justify the large expenditure of money, time, and energy involved."

[Soil fertility experiments], A. N. HUME (*South Dakota Sta. Rpt. 1920*, *pp. 18*, *19*).—Comparative average yields of corn and oats from a grain system and a live-sock system of farming in eastern South Dakota from 1911 to 1918, inclusive, indicated that the corn yields of 1912 and 1913 were higher with the live-stock system receiving manure than with the grain system receiving crop residues. The reverse was true for the succeeding years, but the average results for corn were in favor of the live-stock system. On the other hand, the average of both corn and oats was higher for the grain system.

Six years' experience in improving a light, unproductive soil, B. L. HARTWELL and S. C. DAMON (*Jour. Amer. Soc. Agron.*, *13* (*1921*), *No. 1*, *pp. 37–41*).—Experiments begun in 1913 with six $\frac{1}{4}$-acre plats of unproductive sandy loam soil at the Rhode Island Experiment Station are reported.

The plan was to prepare in different ways for a uniform planting of potatoes in 1917. The cropping system followed is described. The pronounced influence of liming whenever a crop was grown which is sensitive to soil acidity showed that the first consideration should be given to this process in connection with attempts to increase crop production on such soils. "Of the fertilizer elements, phosphorus would probably be used most economically, while legumes should prove beneficial in the long run, not only for collecting nitrogen but for increasing the humus."

Profitable fertilization—choosing a fertilizer, M. E. MCCOLLAM (*Washington Sta., West. Wash. Sta. Mo. Bul.*, *8* (*1921*), *No. 10*, *pp. 146–150*).—Popular information on the selection, purchase, and use of fertilizers is given.

The relation of fertilizers to Hessian fly injury and winterkilling of wheat, W. B. ELLETT and T. K. WOLFE (*Jour. Amer. Soc. Agron.*, *13* (*1921*), *No. 1*,

pp. 12–14).—Data are reported on the wheat experimental plats at the Virginia Experiment Station, which indicate that of the materials used, stable manure and acid phosphate have increased crop yields and lessened the Hessian fly injury and winterkilling to the greatest extent.

Methods of applying manure, W. P. BROOKS (*Massachusetts Sta. Bul. 196 (1920), pp. [2]+39–60, pl. 1, fig. 1*).—Studies begun in 1900, to compare late fall and winter applications of manures with spring application and prompt incorporation with the soil, are reported. During the first 12 years (with one exception) manure was applied annually at the rate of 20 tons per acre. During the succeeding 8 years it was attempted to determine the relative residual effects of the different treatments. The soil used was a moderately strong gravelly loam with a good capacity for retaining and conducting moisture. Both cow and horse manures were applied. The crops grown were corn, millet, soy beans, and mixed grass and clover.

The results are taken to indicate that the manure for the crop of a following season should be incorporated with the soil by the plow or harrow after the removal of the crop in the late fall if practicable rather than spread upon the surface to remain until spring. It is concluded, however, that holding the manure in a large heap until spring is the best plan, because it involves less waste than fall application and during later years, especially, produces larger crops, more rapid early spring growth, and earlier maturity.

Nitrates, phosphates, potash, R. DE BONAND (*Nitrates, Phosphates, Potasse. Paris: Libr. Polytech., 1920, pp. [3]+199, figs. 5*).—This publication is essentially a review of the artificial fertilizer industry, and summarizes available information on the nitrogen, potash, and phosphorus-containing minerals and on processes and treatments to render them available. Data are also presented on production and consumption, and special treatment is given to the manufacture of synthetic products. Part 1 deals with nitrates and nitrogenous compounds, part 2 with phosphates and phosphoric acid, and part 3 with potash and potash salts.

Two years' experience with superphosphate, tetraphosphate, and phosphorite, G. TASSINARI (*Atti R. Accad. Georg. [Florence], 5. ser., 17 (1920), No. 2–4, pp. 153–175*).—Two years' experiments to determine the relative fertilizing values of superphosphate, tetraphosphate, and phosphorite when used on grains are reported.

The superphosphate contained 14.65 per cent of water and citrate-soluble phosphoric acid, the tetraphosphate 1.68 per cent, and the phosphorite 2.12 per cent. The phosphorite showed practically no fertilizing action in either year. The tetraphosphate showed a definite fertilizing action in both years, which was, however, always considerably less than that shown by superphosphate.

Mode of action of superphosphate in calcareous and noncalcareous soils, W. H. HARRISON (*Agr. Research Inst. Pusa Sci. Rpts., 1918–19, pp. 38–40*).—Experiments are reported which showed that the retention of phosphoric acid in calcareous soils is a different phenomenon from that occurring in noncalcareous soils, and that the range over which applications of superphosphate are effective is wide in the case of noncalcareous soils but very restricted in the case of calcareous soils. The conditions for effective phosphatic manuring of calcareous soils are to be studied further.

Molasses as fuel and the preparation of potash from the ashes, G. E. G. VON STIETZ (*Arch. Suikerindus. Nederland. Indië, 28 (1920), No. 15, pp. 519–533*).—General information on the use of molasses as fuel in the sugar industry is given, together with data on the manufacture of potash from the ashes.

It is stated that 30 tons of molasses per day may be produced from 1,000 tons of cane, and that from every 100 tons of molasses about 4.6 per cent of potassium carbonate of 90 per cent purity and 2 per cent of potassium sulphate of 100 per cent purity may be obtained.

AGRICULTURAL BOTANY.

Morphological studies on leaf and flower, H. GLÜCK (*Blatt- und Blütenmorphologische Studien. Jena: Gustav Fischer, 1919, pp. XXIII+696, pls. 7, figs. 295*).—This is an account of a morphological investigation relating to the leaf and flower forms and parts, and containing an extensive bibliography.

Study of seeding and germination in Garcinia mangostana, A. SPRECHER (*Rev. Gén. Bot., 31 (1919), Nos. 371, pp. 513–531, pls. 3, figs. 17; 372, pp. 609–634, figs. 16*).—This is predominantly a morphological study of *G. mangostana* in the earlier stages of its development.

Physiological predetermination: The influence of the physiological condition of the seed upon the course of subsequent growth and upon the yield.—III–V, Review of literature.—Chapters II–IV, F. KIDD and C. WEST (*Ann. Appl. Biol., 5 (1919), No. 3–4, pp. 157–170, 220–251, figs. 3; 6 (1919), No. 1, pp. 1–26, pl. 1, figs. 3*).—This concludes the review of the literature bearing upon what is termed physiological predetermination. The authors summarize the evidence available on the subject, this as a whole seeming to show that the factors which influence the plant during its earliest stages of development have a more or less pronounced effect upon the whole of its subsequent life history.

Chapter I of this review (E. S. R., 43, p. 224) dealt with factors acting upon the plant while still a seed upon the parent. The most useful criterion here was found to be the size of the seed. The effects of the parental environment of a seed were apparently sometimes visible only in the resulting plant.

Chapter II deals with the influence of the degree of maturity of the seed at the time of harvesting upon its potentiality. The conclusion reached is that all comparisons made between mature and immature seeds were vitiated by the fact that immature seeds deteriorate more rapidly under storage conditions than do mature seeds. In many cases it was found that the yield per plant from immature seed was at least equal to that from mature seed.

Chapter III critically reviews the work dealing with the soaking of the seed in water or salt solutions.

Chapter IV reviews more particularly facts brought out by work on the effect of low temperatures in predetermining the time of flowering of spring-sown winter cereals. This effect of exposure to low temperatures is a very clear and distinct phenomenon, which, though it remains unexplained, bears out the general thesis that the external conditions which obtain during the early stages of the development of the plant have a very pronounced effect upon its subsequent development. All available evidence supports the conclusion that where germination and early seedling growth are stimulated by chemical treatments of the seed the subsequent growth and final yield are favorably influenced in proportion. The present review of literature has emphasized the fact that normal plant growth falls into line with a compound interest law of development.

The influence of temperature on the soaking of seeds, F. KIDD and C. WEST (*New Phytol., 18 (1919), No. 1–2, pp. 35–39, fig. 1*).—Having observed in the course of work previously noted (E. S. R., 40, p. 727) a considerably greater injurious effect (as regards both germination and vigor) produced by soaking seeds at 5 to 10° than by soaking them at 20° C., the authors have since car-

ried out experiments with peas. Essentially the same results were obtained, these being presented in tabular form with discussion. At higher temperatures the amount of injury again increases, showing the optimum temperatures to lie in the neighborhood of 15 to 20° C.

Studies on the chondriome in plants, and on the origin of chromoplasts and the manner of formation of xanthophyll and carotin pigments: A physiological study of the cell, A. GUILLIERMOND (*Rev. Gén. Bot., 31 (1919), Nos. 369, pp. 372–413, pl. 1; 370, pp. 446–508, figs. 11; 371, pp. 532–603, pls. 10, figs. 6; 372, pp. 635–770, pls. 25, figs. 18*).—Reference is made to previous publications on phases of the general subject of chondriomes in plants (E. S. R., 39, pp. 528, 730; 40, p. 425; 41, p. 818; 42, p. 228), claimed to have shown that the formations known under the name of plasts, plastids, or leucites, result from the differentiation of mitochondria analogous to those in animal cells (so that it may be proper to think of these as specialized forms in the great array of mitochondria, regarded as cytoplasmic elements, probably the seat of a large number of elaborate activities). The author also reports on an extended study of the formation of vegetable pigments, of the activities in the chondriome, and of the action of fixatives on mitochondria and cytoplasm.

Summing up the data obtained and conclusions therefrom, the author states that living epidermal cells of tulip and of *Iris germanica* show with remarkable clearness their cytoplasm and chondriomes. A descriptive discussion of these is given, with inferences regarding changes observed to occur in certain cell contents.

It is stated that the pigments of epidermal cells are elaborated in the chondriocontes or plasts, apparently in most cases without the necessity of previous formation of chlorophyll. The observed facts do not, therefore, favor the view that xanthophyll and carotin are derived from chlorophyll, except possibly in certain cases where the transitory formation of chlorophyll precedes formation of those pigments. The intermediary action of mitochondria is discussed in connection with processes in relation to elaboration of certain animal pigments.

On the present status of the chondriosome problem, J. DUESBERG (*Biol. Bul., 36 (1919), No. 2, pp. 71–81, fig. 1*).—The author cites investigations claimed to prove that chondriosomes are not artifacts, since they appear in fixed and stained preparations much as they do in the living cell. It is claimed that these structures are identical with most or all of the cell elements or constituents that have been referred to under different names in recent discussions. The morphology of that same substance, as observed in different cells or at different life periods, is now known to be subject to great variations. Examples of these facts are given. It is further claimed that chondriosomes exist in practically all animal and vegetable cells, the only exception here asserted being the superficial cells of the epiderm in animals; that is, cells the protoplasm of which is entirely differentiated and transformed completely into what is a practically new substance.

Consideration is also given to the rôle played by the chondriosomes in the processes of differentiation and in fertilization, and to the question whether chondriosomes constitute an idioplasmic substance.

A misconception as to the structure of the ear of maize, P. WEATHERWAX (*Bul. Torrey Bot. Club, 47 (1920), No. 8, pp. 359–362, figs. 6*).—The author criticizes what is claimed as a misconception in Collins's explanation of the irregularity in the continuity of the rows often observed in ears of corn (E. S. R., 41, p. 436). A simple technique exposing the alveoli is claimed to show that the difference (some multiple of two) in the number of rows of

grains on the ear is due to the discontinuance of a row of pairs of spikelets and not to the abortion of the pedicelled spikelets of two such rows. It is claimed there is nothing to indicate that short rows represent long rows partially aborted.

Duration of the several mitotic stages in the dividing root-tip cells of the common onion, H. H. LAUGHLIN (*Carnegie Inst. Wash. Pub. 265 (1919), pp. 48, pls. 7*).—This account gives details of a study carried out with *Allium cepa* and claimed to justify the soundness of the methods employed (both statistical and cytological) of measuring both the relative and the absolute duration of the several (arbitrarily delimited) stages in the progress of cell division. The results of the study are tabulated with discussion.

It is found that each mitotic stage presents characteristic velocity reactions to temperature increments. These reactions approximate expectation under the Van't Hoff formula, and this fact suggests that the activities constituting each mitotic stage are composed of the actions and interactions of those much more elementary physical and chemical forces which measured in more isolated relations have been shown to react in the same manner as regards velocities.

A study of ovular pistillody, R. SAVELLI (*Ann. Bot. [Rome], 15 (1920), No. 1, pp. 1–27, pl. 1*).—This contribution gives, besides a descriptive discussion regarding ovular metamorphoses in *Datura stramonium, Nicotiana rustica, N. sylvestris,* and *Dianthus caryophyllus,* an account of studies on relations between ovular pistillody and associated anomalies, with discussion of the significance of pistillody.

Radical tubercles of Datisca cannabina, G. SEVERINI (*Ann. Bot. [Rome], 15 (1920), No. 1, pp. 29–52, pls. 2*).—Root tubercles of *D. cannabina* are discussed as regards their anatomy, formation, and associated bacteria, which are said to resemble in certain respects *Bacillus radicicola.*

[Exchange between plant and external medium], H. DEVAUX (*Soc. Sci. Phys. et Nat. Bordeaux, Proc. Verb., 1915–16, pp. 35–46, 66–70*).—These reports and that previously noted (E. S. R., 36, p. 224) deal with the displacement of calcium and other bases, fixed in the living plant, by other bases in the external medium; reversible exchanges between plant and medium; and rapid fixation by the plant of iron and other heavy metals, also displacement of metals, fixed in the plant, by other metals.

The physiology and biology of [plant] excretions, E. STAHL (*Flora [Jena], n. ser., 13 (1919), No. 1–2, pp. 1–132, pls. 3*).—This account deals with inner and outer excretion in plants as regards the substances, processes, and relations involved.

The lipoid content of plasma in Monotropa hypopithys and Orobanche speciosa, W. BIEDERMANN (*Flora [Jena], n. ser., 13 (1919), No. 1–2, pp. 133–154, pls. 2*).—This is a detailed account with discussion regarding methods and results of study by the author on lipoids in the cell sap of *M. hypopithys* and *O. speciosa.*

On the relation of plasmolysis to the shrinkage of plant tissue in salt solutions, W. STILES and I. JÖRGENSEN (*New Phytol., 18 (1919), No. 1–2, pp. 40–49, figs. 2*).—Besides a discussion of comments by Thoday (E. S. R., 39, p. 731; 41, p. 525) as bearing upon the claims made previously by the present authors (E. S. R., 39, p. 228), this article reports the results of their experimentation with red beet root. The gain or loss in weight of tissue immersed in solutions differing in concentrations of sodium chlorid was measured in the manner described in their previous paper.

Some factors in plant competition, W. E. BRENCHLEY (*Ann. Appl. Biol., 6 (1919), No. 2–3, pp. 142–170, pl. 1, figs. 10*).—A study of mustard and barley

grown under conditions of competition as regards the factors food, water, and light, and also possible toxic excretions from roots, is said to have shown that when the food supply is limited food becomes the dominant factor in competition, and that this is particularly true of available nitrogen. The total growth measured in dry matter seems to be determined by nitrogen supply, irrespective of the number of plants. Under limited food supply the efficiency index of dry weight decreases with the number of plants.

The decrease of light by overcrowding is an important factor even when food and water are sufficient for individual plants. With barley the effect of light competition shows in the reduction of the number of ears, irregularity in the number of tillers produced, reduction of dry matter, increase of shoot growth at the expense of root growth, increase of variation in the efficiency indices of dry weight production, and decrease in the power of the plants to utilize food supplied to the roots. With adequate illumination of barley there is a tendency toward the production of a standard type of plant in which indices, and ratios of root to shoot approximates within variable degrees to a the relation between the number of tillers and ears, dry weights, efficiency constant standard. With overcrowding this approximation entirely disappears.

The influence of soil dryness on plants, A. Rippel (*Bot. Centbl., Biehefte, 36 (1919), 1. Abt., No. 2, pp. 187–260, figs. 8*).—This is a study of the effect of soil dryness on the anatomical characters and the physiological and developmental history of plants, in particular *Sinapis alba*.

The theory of Mendel and mutation, G. Sergi (*Riv. Biol., 1 (1919), No. 5–6, pp. 615–655*).—This is a critical review of evidence and opinions on various phases of genetics and evolution and their significance.

FIELD CROPS.

Permanence of differences in the plats of an experimental field, J. A. Harris and C. S. Scofield (*Jour. Agr. Research [U. S.], 20 (1920), No. 5, pp. 335–356*).—Studies conducted for nine years by the U. S. Department of Agriculture, on the permanency of differences found in the productivity of the plats of an experimental irrigated field and on the influence of variations in the yields of certain crops in rotations upon the yields of certain crops in rotations upon the yields of subsequent crops, are reported.

The studies were conducted on 46 plats 0.17 acre in area, subdivided in several cases into half and quarter plats. A previous study (E. S. R., 43, p. 526) indicated the heterogeneity of experimental fields and that the correlation between the yields of adjacent plats may be due either to initial physical and chemical differences in the soil or to the influence of previous crops upon the composition, texture, or tilth of the soil.

A uniform cropping experiment involving sugar beets, alfalfa, corn, oats, and barley was initiated to determine the variation in the yield in different years of plats of a given size homogeneously planted and uniformly treated. It was found that of 152 correlations between the yields of the plats in different years, 133 were positive and 19 negative. The data from the half and quarter plats confirmed those from the whole plats.

These results are taken to indicate that plats, even of the small size and apparent uniformity of those studied, are characterized by differences which may persist throughout a period of years, and that, in general, plats which produce more in one year will produce more in another year. These results are not considered to establish a universally applicable principle, however, due to the fact that meteorological as well as soil conditions influence yields.

"It is quite probable that certain soil characteristics would result in maximum yields with one set of meteorological conditions, but in minimum yields with another complex of aereal conditions."

Owing to the early introduction of alfalfa in the rotation and to the fact that it occupied the soil for three of the nine years, "it seems quite possible that the correlation between certain of the yields is due in part to the variation in nitrogen content of the soil referable to the variation in thickness of stand and strength of growth of the alfalfa crops. The results show that there is but little correlation between the alfalfa yields of 1912 to 1914 and the ear-corn yields of 1915, whereas the correlations for ear corn in 1916 are high. Thus the influence of alfalfa upon the yield of a subsequent crop is not fully evident until the second year after it is turned under. There is a definitely demonstrable residual influence of the variation of alfalfa yields upon the yields of subsequent crops."

The agronomist's part in the world's food supply, F. S. Harris (*Jour. Amer. Soc. Agron., 12 (1920), No. 8–9, pp. 217–225; also in Science, n. ser., 52 (1920), No. 1348, pp. 395–400*).—This address has been noted (E. S. R., 44, p. 98).

[Field crops work in Nova Scotia in 1919], J. M. Trueman (*Nova Scotia Sec. Agr. Ann. Rpt., 1919, pt. 1, pp. 23–32, pls. 3*).—Experiments with field crops conducted at the Nova Scotia Agricultural College in 1919, including rotation, fertilizer tests with hay crops, oats, and mangels, tests of oat varieties, and field trials of wheat, barley, turnips, and silage crops, are described.

[Report of work with field crops in Switzerland, 1913–1919], A. Schmid (*Ann. Agr. Suisse, 21 (1920), No. 1, pp. 2–4, 5*).—This briefly summarizes the results of cultural and variety tests and breeding work with cereals, stock beets, potatoes, rape, field cabbage, and miscellaneous forage crops conducted at Oerlikon, Leibefeld, and Lausanne, Switzerland, from 1913 to 1919.

Report of the Bavarian Cereal Breeding Station in Weihenstephan, 1914–1918, L. Kiessling (*Landw. Jahrb. Bayern, 9 (1919), No. 6–8, pp. 318–402, 431–455*).—Results of breeding work and cultural, fertilizer, and variety tests with cereals, legumes, root crops, oil seed plants, and miscellaneous grasses conducted in the period 1914–1918 in continuation of that noted previously (E. S. R., 33, p. 831) are summarized. The author also reports on the progress of seed certification and inspection work with the above crops in Bavaria.

[Report of field crops work in the United Provinces of Agra and Oudh, India], B. C. Burt, G. Prasad, and L. C. Sharma (*United Provs. Agra and Oudh, Agr. Stas. West Circle Rpt. 1919, pp. [4]+22; United Provs. Agra and Oudh Dept. Agr. Rpt. 1919, pp. 1a, 3a–7a, 8a–11a*).—Results of variety, cultural, and fertilizer tests conducted on several experimental farms in the region with cotton, castor beans, wheat, sugar cane, and miscellaneous field crops are reported for the year ended June 30, 1919.

[Report of field crops work in the Central Provinces and Berar, India, 1919], R. G. Allan et al. (*Cent. Provs. and Berar [India] Dept. Agr., Expt. Farm. Agr. Col., Nagpur, Rpt. 1919, pp. 3–12; Agr. Stas. North. Circle Rpt. 1919, pp. 5–17, 19–22, 25–27, 28, 30–33, 35, 36, 39–49; South. Circle Rpt. 1919, pp. 1–17, 19, 21–30, 32, 33, 35–48, 51–54, 57–61, 63, 67, 68, pls. 6; Rpt. Demon. Work North. Circle, 1919, p. 20; South. Circle, 1919, pp. 5–14; Agr. Col., Nagpur, Bot. and Chem. Research, [etc.] Rpt. 1919, pp. 13–15, 16, 17; Cent. Provs. [India] Dept. Agr. Rpt., 1918–19, pp. 3–12, 15–19, pl. 1*).—These describe the continuation of work previously noted (E. S. R., 42, p. 132), including variety, cultural, rotation, and fertilizer tests with wheat, rice, jowar, sugar cane, gram, cotton, and

miscellaneous field crops conducted on various experimental farms in Central India.

[Report of field crops work in Assam], A. A. MEGGITT ET AL. (*Assam Dept. Agr. Expts. Rpts., 1919, pp. 5–15, 22–26, 31–41, 76–85, 95–105, 111–125, 127, 132–138, 139–143, 148–155, 157, 158; 1920, pp. 4–29, 33–40, 79–86, 95–105, 112–129, 133–143, 152–154, 155–157*).—The continuation of work previously noted (E. S. R., 41, p. 334), including variety, fertilizer, and selection trials with sugar cane, rice, and potatoes, and field tests with miscellaneous crops conducted at several experiment stations in the Assam Valley is described for the years ended March 31, 1919, and March 31, 1920.

Rice, selected by sinking when immersed in saturated brine, produced acre yields of 1,962 lbs. in 1917 and 1,468 lbs. in 1918, as compared with 1,784 and 1,347 lbs., respectively, from unselected seed in the same years.

Potatoes from the summer crop, stored during the winter in shallow sprouting boxes in a well-lighted shed, produced short, well-formed sprouts, and the average acre yield of six varieties was 4.45 tons in 1918 and 7.26 tons in 1919. Under similar field conditions, unsprouted seed of the fall crop of the same size and weight, but of nearly double monetary value, yielded 4.41 and 5.58 tons, respectively, for the same years.

[Report of field crops work in Punjab], D. MILNE, W. ROBERTS, FATEH-UD-DIN, D. SINGH (*Punjab Dept. Agr. Rpt. 1919, pt. 1, pp. V, VI, X, XI, XV, XVII, XVIII*).—The results of limited variety tests with wheat, cotton, sugar cane, and rice, and cultural and irrigation tests with cotton are reported, together with considerable tabulated data on crop production and crop values.

[Field crops work of the Agricultural Research Institute, Pusa, 1918–19], W. SAYER and A. and G. L. C. HOWARD (*Agr. Research Inst. Pusa Sci. Rpts. 1918–19, pp. 11–18, 46–61, 66, 67, pls. 2*).—Results of cultural, variety, and irrigation tests and breeding work with wheat; growth studies, seed production, field trials, and breeding work with indigo; and pollination studies of various Indian crops conducted during the year ended June 30, 1919, are described.

[Report of field crops work in the Dutch East Indies] (*Dept. Landb., Nijv. en Handel Nederland. Indie, Jaarb., 1917, pp. 186–242, fig. 1; 1918, pp. 63–104, 128–138, pl. 1*).—Continuing work previously noted (E. S. R., 41, p. 638), cultural and variety tests and breeding work with tobacco, rice, and cassavas and miscellaneous tests with other important crops conducted during 1917 and 1918, are described.

British grasses, J. F. MCGILL (*Ayr, Scotland: McGill & Smith, Ltd., 1920, pp. [8], pls. 65*).—This book comprises a set of photographs of 65 British grasses depicting the peculiarities of the roots, stems, and flowering heads. The character of growth, type of root, and flowering periods are indicated in brief foot notes.

Para and Paspalum grasses, G. BRIGGS (*Guam Sta. Circ. 1 (1921), pp. 10*).—This circular describes Para and Paspalum grasses and presents popular instructions for their culture in Guam.

The influence of soil reaction on the growth of alfalfa, J. S. JOFFE (*Soil Sci., 10 (1920), No. 4, pp. 301–307, fig. 1*).—In this contribution from the New Jersey Experiment Stations, results of experiments in which alfalfa was grown in pots containing soil the reaction of which was adjusted by the use of sulphuric acid and calcium carbonate, are reported. A series of 20 cultures was prepared showing a range in the H-ion concentrations of the soil extracts varying at somewhat irregular intervals from a pH value of 3 to one of 7.1. Water extracts of the soil from each culture were prepared at regular in-

tervals during the growth of the plants and the H-ion concentrations determined by the colorimetric method. The observations recorded may be summarized as follows:

The germination of alfalfa seeds was practically the same with pH values of the soil varying from 4.5 to 7, but was greatly reduced in cultures which yielded soil extracts having pH values below 4.5. Yields of alfalfa tops showed a gradual increase with an increase in the pH values of the soil extracts from 3.8 to 7. The alfalfa plants experienced difficulty in becoming established in cultures yielding soil extracts with high H-ion concentrations, but after becoming established they showed normal green color, high vigor, and made excellent growth in soil having a pH value as low as 3.8.

With increasing H-ion concentration of the soil extracts, nodule formation on the roots of the plants was correspondingly less abundant. Plants in the cultures which yielded soil extracts with very low H-ion concentrations showed poorer root development than did the plants in the cultures with higher H-ion concentrations of the soil extracts. The nitrogen content of the plants showed a gradual increase with a corresponding decrease in the H-ion concentration of the soil extracts.

Arrowroot: Culture and industry [in Brazil], A. Ribeiro de Castro Sobrinho (*A Araruta: Cultura e Industria. Rio de Janeiro: Min. Agr., Indus. e Com., Deleg. Exec. Prod. Nac., 1919, 2. ed., pp. 25, figs. 16*).—Cultural practices followed in growing the crop, and the various processes involved in the production of starch from the rhizomes are described in some detail in this publication.

Smooth-awned barleys, H. V. Harlan (*Jour. Amer. Soc. Agron., 12 (1920), No. 6–7, pp. 205–208, fig. 1*).—The author describes smooth-awned barley (*Hordeum leiorrhynchum*), indicates the differences existing between this type and hooded, awnless, and the common rough-awned barleys, and reviews the work of the Office of Cereal Investigations of the U. S. Department of Agriculture and the Minnesota Experiment Station in studying this type of barley. The important introductions of smooth-awned barley are said to have originated in Russia, Asia Minor, and Algeria.

With equal yields farmers would prefer the smooth-awned type, and a high yielder would doubtless result in an increased barley acreage. From results secured to date, the author sees no reason why high yielding smooth-awned barleys can not be produced, as the original importation of *H. leiorrhynchum* have yielded as well as the average importations of rough-awned barleys. However, the absence of smooth-awned varieties in commercial culture in Europe and Asia are held to indicate some sort of weakness at present unexplained.

Relative yields from broken and entire kernels of seed corn, E. B. Brown (*Jour. Amer. Soc. Agron., 12 (1920), No. 6–7, pp. 196, 197*).—Comparative tests between whole kernels of corn and kernels from the same ear, broken in a way similar to injuries occurring in mechanical shelling and seeding, are reported in this contribution from the Office of Cereal Investigations of the U. S. Department of Agriculture. The injuries were confined to the endosperm.

The broken kernels made an acre yield of 64 bu. and the entire seed 71.6 bu. Besides possessing weaker seedlings the field germination, weight of ear, yield per plant, and acre yield of the broken seed were all less than those of the uninjured kernels. Because of poorer stands, the average number of ears per plant of the broken seed exceeded the number from the entire seed. Mutilation of seed was not thought to be a limiting factor in height, as the general height of plants did not differ materially at maturity.

[Reports of Ontario Corn Growers' Association, 1917, 1918, and 1919] (*Ontario Dept. Agr., Corn Growers' Assoc. Ann. Rpt., 1917, pp. 24; 1918, pp. 24; 1919, pp. 31, figs. 6*).—The activities of the association are reported for the years indicated.

Cotton variety tests, 1915–1919, R. R. CHILDS (*Ga. Col. Agr. Bul. 200 (1920), pp. 28, figs. 8*).—Considerable agronomic and yield data on different varieties of cotton grown on the college demonstration farm, Athens, Ga., from 1915 to 1919 are presented and discussed, together with notes on deterioration of varieties, improvement on the farm, and seed selection.

From the standpoint of earliness, continuous fruiting and total yield, College No. 1, strains of Cleveland, Hoopers, Trice, Sunbeam, Cooks, and Texas Bur are considered most promising. On wilt-infected land, Lewis 63 and strains of Toole are recommended. Express, Webber 49, Dixafifi, Foster, and Meade are indicated as valuable long-staple varieties.

A study of cotton marketing conditions in Arkansas, C. E. ATKINSON, J. B. BEERS, and D. E. EARLE (*Ark. Agr. Col. Ext. Circ. 92 (1920), pp. 15, fig. 1*).—This publication presents and discusses tabulated data concerning the percentages of different staple lengths of cotton classed in Arkansas counties during the seasons of 1915–16, 1916–17, 1917–18, and 1918–19, and the prices received for the several lengths of staple before and after classing and stapling in primary and spot markets in the State.

Report of the imperial cotton specialist, G. A. GAMMIE (*Agr. Research Inst. Pusa Sci. Rpts., 1918–19, pp. 115–124*).—Yields, ginning percentages, lint characters, and acre values of cotton varieties and selections from several localities in the Bombay Presidency and Central India are reported.

Fiber plants of Indo-China: The cotton plants of Indo-China, C. CREVOST and C. LEMARIÉ (*Bul. Econ. Indochine, n. ser., 22 (1919), No. 136, pp. 368–401, pls. 3, fig. 1*).—Species and varieties of cotton agriculturally important in Indo-China are described, and cultural methods employed in the production of the crop in Cambodia, Laos, Tonkin, Annam, and Cochin China are outlined. Considerable information regarding the production, home consumption, and trade in cotton in the several Provinces is also included.

Flax and its products, H. R. CARTER (*London: John Bale, Sons & Danielsson, Ltd., 1920, pp. VII+311, figs. 33*).—This handbook comprises a revision of the material included in Flax: Its Cultivation and Preparation for Market, already noted (E. S. R., 40, p. 827) in addition to a concise description of the processes of spinning, weaving, and finishing flax fabrics; the manufacture of linen threads, flax gaskin, linseed oil and cake, and other flax products; and a brief history of the linen trade. The outstanding events of flax culture in the British Isles in 1918, 1919, and 1920 and the effects of war upon the industry are discussed in detail in a rather extended appendix.

Fertilizing the Irish potato crop, B. F. FLOYD and R. W. RUPRECHT (*Florida Sta. Bul. 158 (1920), pp. 28, figs. 2*).—Experiments to determine the value of raw Florida phosphate and acid phosphate in fertilizers for potatoes, and the use of fertilizers containing various percentages of potash, are reported. Field experiments were conducted from 1918 to 1920 on virgin sandy loam soils, and greenhouse experiments on a sandy loam cropped repeatedly with velvet beans and other crops without fertilizer.

Although the experiments gave no conclusion regarding the most profitable amount of fertilizer to be used, or the best sources or combination of sources of ammonia and potash, they are held to prove that both phosphoric acid and potash are limiting factors for growth and yields in the region and must be supplied to produce profitable crops. The authors consider that the results show

that soluble phosphoric acid was necessary in the early stages of growth to produce vigorous plants. Raw rock phosphates failed to produce maximum top growth. In 1920 pebble phosphates gave a yield nearly equaling that from acid phosphate, but soft phosphate did not prove equal to pebble phosphate. With a deficiency of potash tubers did not attain full size, and in cases of extreme scarcity the normal growth of tops was also checked and certain appearances characteristic of potash starvation developed.

Culture of floating rice in Cochin China, TRAN-VAN-HUU (*Bul. Agr. Inst. Sci. Saigon [Cochin China], 2 (1920), No. 2, pp. 46–52*).—The floating rice (*Oryza sativa fluitans*) of Cambodia and its peculiar habit of growth are described, leading varieties noted, and cultural and field practices employed in the production of the crop along the Mekong River outlined.

Cultivation of drilled paddy in South Bombay Presidency, T. GILBERT and S. S. SALIMATH (*Bombay Dept. Agr. Bul. 82 (1916), pp. 9, pls. 25*).—This publication describes the cultural and field practices employed in the production of the rice crop in South Bombay Presidency, India, and illustrates the cultural implements used by the natives in the region. Rice varieties of economic importance are indicated, and data on the cost of production are included.

The sugar beet, L. MALPEAUX (*La Betterave à Sucre. Paris: Libr. Hachette & Co., 1919, 3. ed., pp. [4]+128, figs. 59*).—A third and revised edition of a popular handbook noted previously (E. S. R., 21, p. 138).

The question of the distance between cane rows, A. H. ROSENFELD (*Internatl. Sugar Jour., 22 (1920), Nos. 262, pp. 558–565; 263, pp. 629–635*).—From an extensive survey of experiments on the spacing of sugar cane conducted since 1890 in Louisiana, Tucumán, Hawaii, Cuba, and Guadeloupe, the author concludes that sugar cane should be planted in rows as close together as is consistent with proper cultivation with modern machinery. This distance appears to be about 5 ft. for the thicker types of cane, such as Cheribon, Lahaina, and B. 208, and from 5.5 to 6 ft. for the more abundantly suckering types, such as the Java canes, the Uba, and the Japanese bamboo type.

A preliminary note on the behavior in North India of the first batch of sugar cane seedlings distributed from the Sugar Cane Breeding Station, Coimbatore, T. S. VENKATRAMAN (*Agr. Research Inst. Pusa Bul. 94 (1920), pp. 17, pls. 8*).—Agronomic data and chemical analyses of sugar cane seedlings grown in various localities in North India are presented, together with an outline map of India showing the acreages under sugar cane and the production of crude sugar in the different Provinces.

The specific gravity of sugar cane, J. SCHMUTZER (*Arch. Suikerindus. Nederland. Indië, 26 (1918), No. 14, pp. 545–647, figs. 49*).—Results of detailed studies of the specific gravities of several varieties of sugar cane, made by immersion at the Gondang Lipoero factory (Java) to determine the value of this factor as an indicator of maturity, are presented.

It is noted that the specific gravity of sugar cane increases progressively during the period of ripening. This increase is greater than that of the specific gravity of the sap alone and is held to be due to an increase in the specific gravity of the tissue, caused by the continuous contraction of the culm. A close relation is said to exist between this contraction and the absorption of water by the plant. The author suggests in conclusion that, although the determination of specific gravity can give no indication of the time of perfect maturity, it might be of value in estimating the weight of cane.

Grow sweet potatoes, T. H. MCHATTON, J. W. FIROR, and G. JONES (*Ga. Col. Agr. Bul. 209 (1920), pp. 32, figs. 14*).—A treatise on the culture of sweet potatoes in Georgia, discussing adaptation, cost of production, varieties, cultural prac-

tices, pests, and marketing the crop. Brief general information is given on the construction of storage and curing houses, together with bills of materials, cost estimates, and drawings of special construction details.

Regulations of the Secretary of Agriculture under the United States Warehouse Act of August 11, 1916, as amended July 24, 1919.—Regulations for tobacco warehouses (*U. S. Dept. Agr., Off. Sec. Circ. 154* (*1920*), *pp. 35*).—This circular contains the regulations of the Secretary of Agriculture for tobacco warehouses under the United States Warehouse Act of August 11, 1916 (E. S. R., 35, p. 308), as amended July 24, 1919. The amended text of the act is included.

Earliness and rustiness of spring wheats, H. L. WALSTER (*North Dakota Sta. Bul. 143* (*1920*), *pp. 8, fig. 1*).—This publication reports mainly comparisons of Marquis and five other Canadian wheats, Red Bobs, Prelude, Ruby, Kitchener, and Pioneer, as to yields, earliness, and susceptibility to rust under North Dakota conditions. Brief accounts of the origin and descriptions of the six varieties are included.

In the work at Fargo, Power Fife, Bluestem, and Kitchener were found to be later than Marquis; Red Bobs, Ruby, and Prelude earlier than Marquis; and Preston to ripen about the same time. All of these were inferior to Marquis in yield and were more susceptible to rust. The amber durums, such as Kubanka, Monad, and Acme, were later, less susceptible to rust, and gave higher yields than Marquis, while Arnautka was inferior to Marquis in yielding ability.

At Dickinson, Red Bobs, Ruby, Prelude, and Pioneer were earlier than Marquis, and Kitchener was later. All were inferior to Marquis in yield except Red Bobs, which exceeded that of Marquis by 0.7 bu. in two seasons. All varieties matured in less time than at Fargo.

Results of studies at the Brandon (Manitoba) Experimental Farm, reported by W. C. McKillican, indicated that Red Bobs and Ruby were, respectively, two and five days earlier than Marquis, while Kitchener was slightly later. All of these were inferior to Marquis in yield and did not exhibit superior rust resistance.

The inheritance of earliness and lateness in wheat, W. P. THOMPSON (*Roy. Soc. Canada, Proc. and Trans., 3. ser., 13* (*1919*), *Sect. V, pp. 143–162*).—This paper presents and discusses records of the length of growth period in many F_3 families of several crosses between wheat varieties differing by various degrees in regard to this character. The F_3 families of hybrids were grown in 1918 in order to determine the exact constitution of the F_2 plants and to test the theoretical conclusions reached in the work already reported (E. S. R., 40, p. 830).

In all cases families were obtained which corresponded with the parental types. Although some families earlier than the early parents were obtained, most were intermediate and all possible intermediate positions were occupied. That the spread of the families in this way was not due to environmental influences, even in the crosses involving only a small difference, was indicated by the general agreement between F_2 plants and their F_3 families in the order of their arrangement according to earliness. No evidence of special groupings of families was noted.

Considerable difference was found in the variability of different families and in the distribution of individuals within a family, evidently due to differences in the genetic constitution of the F_2 parents. Conclusions based on the proportion of very variable families or the proportion of families which

occupied a given position with respect to one parent were not found possible from the limited data.

The only conclusion held possible on the basis of the multiple-factor hypothesis of blending inheritance "is that even slightly different parental varieties differ by several factors. Segregation will then produce races whose genetic differences are so slight as to be obscured by environmental influences.

"From the practical point of view the chief conclusion is that by crossing an early with a later type, races can be established from a reasonable number of F_2 plants, whose means will occupy any position from that of the early parent to that of the later. The great majority of races will occupy some intermediate position. Consequently if it is desired to combine earliness in as great a degree as it is shown in the early parent with several desirable qualities of the later parent, it will be necessary to grow a very large number of F_2 plants. But if it is sufficient to combine an intermediate degree of earliness with characteristics of the late parent, the task is comparatively easy. When certain varieties are used in crossing it is apparently possible to secure races earlier than either parent."

HORTICULTURE.

Federal and State laws regulating the propagation and distribution of nursery stock, L. HASEMAN (*Missouri Sta. Circ. 99* (*1920*), *pp. 24*).—This circular has been prepared especially for the use of Missouri nurserymen and fruit growers, and includes in brief form the present Federal quarantine regulations affecting the importation of nursery stock from abroad and the movement of stock within the United States, and a brief summary of the various State laws and regulations.

[Report of the] department of horticulture, N. E. HANSEN (*South Dakota Sta. Rpt. 1920, pp. 23–26*).—This report deals largely with progress made in breeding hardy fruits for the northwest prairie region. The following apple varieties sent out in the spring of 1920, all one year buds on Red Siberian stocks, are described: Hopa Red-Flower, Cathay, Red Tip, Nocalyx, and Sapinia crabs; and Anoka and Chance apples.

The home orchard, O. B. WHIPPLE (*Montana Sta. Circ. 92* (*1920*), *pp. 29, figs. 11*).—Practical instructions and suggestions are given for the development of a home orchard in Montana. The different operations, such as selecting the site, preparing the soil, choosing varieties, planting, pruning, cultivation and irrigation, and tree protection are discussed in detail.

The fertilization of apple orchards, W. H. ALDERMAN and H. L. CRANE (*West Virginia Sta. Bul. 174* (*1920*), *pp. 51, figs. 6*).—A progress report of orchard fertilization investigations conducted at Grape Island and Sleepy Creek, W. Va. The subject is introduced by a review of the more important orchard fertilizer experiments in this country and England, the authors pointing out the impossibility of shaping any definite conclusions from such a mass of conflicting evidence.

Four experiments, the objects of which were to determine the value of nitrogen, phosphoric acid, and potash, applied singly and in various combinations, as fertilizers for West Virginia apple orchards, are reported upon. The experiments include 398 trees of various ages and vigor, but all grown under the clean cultivation and cover crop practice of soil management during the experimental periods. Data are presented in tabular form, accompanied by discussion of results.

The effect of the fertilizer treatments was determined by measurements of the annual increase in growth and by yield of fruits. No noticeable benefits

were derived from the use of potassium nor phosphoric acid, although the latter material exerted a beneficial effect on the growth of cover crops. Nitrogen proved of value to bearing trees in soils of low fertility. A study of the effect of early and late applications of nitrate of soda led the authors to conclude that this fertilizer was of greatest benefit when used at the time the fruit buds are breaking.

The authors conclude that lack of soil fertility is not generally the limiting factor in West Virginia orchards. More often inferior soil and orchard management is the cause of poor results. The average well cared for West Virginia orchard is not deemed likely to respond sufficiently to applications of commercial fertilizers to warrant their use. Young bearing trees on poor soils and other bearing trees making short terminal growths and with leaves turning yellow early in the season should be supplied with some readily available form of nitrogen. Orchard fertilization should be considered in conjunction with other orchard practices such as culture, spraying, and pruning.

A bibliography of 80 titles is included.

Experiments in fertilizing apple orchards, C. E. STOCKDALE (*West Virginia Sta. Circ. 31 (1920), pp. 4, figs. 2*).—A popular summary of the above.

Moving 10-year-old apple trees, F. C. SEARS (*Country Gent., 86 (1921), No. 10, pp. 8, 40, figs. 4*).—A popular article describing the author's successful experience in his own orchard, at Amherst, Mass., in the removal and resetting of McIntosh fillers The operation was essentially as follows:

A circular trench 2 ft. in depth was dug around the tree just before the advent of severe freezing weather and an effort made to cut in under the tree. The remaining ball of earth surrounding the root, approximately 5 ft. in diameter, was allowed to freeze solid. Meanwhile the new location was determined and protected by a thick mulching of strawy manure, rendering possible digging after continued freezing weather. The tree was lifted from the hole and moved by the aid of horses and a stone boat. Severe pruning was practiced to offset the loss of roots, and nitrate of soda, acid phosphate, and manure applied to stimulate recovery. The actual cost of transplanting a tree was $3.80. After a year's observation of the transplanted tree the author considers the experiment sufficiently successful to justify the operation.

Propagation of vines, F. T. BIOLETTI (*California Sta. Circ. 225 (1920), pp. 4*).—Practical instructions for the propagation of the grape are presented, with directions for making and handling cuttings.

Some changes in Florida grapefruit in storage, L. A. HAWKINS and J. R. MAGNESS (*Jour. Agr. Research [U. S.], 20 (1920), No. 5, pp. 357–373*).—A report of two years' investigations conducted by the Bureau of Plant Industry, U. S. Department of Agriculture, upon the effect of several different storage temperatures upon grapefruit, primarily in reference to the acid and sugar content of the pulp. In 1917–18 temperatures of 32 and 86° F. were employed, and in the following year the completion of a modern storage plant enabled the use of several temperatures, namely, 32, 36, 40, 70, and 86°. Eight tables are included in the text, giving in detail the results of determinations made upon the percentage of sugar, acid, dry matter, shrinkage of fruit, peel, and thickness of the peel of the fruits involved in the different experiments.

General observations by the authors upon the results of the experiments draw attention to the following important points: Grapefruit keeps longer in cold storage than in either common or warm storage, due to less decay from rot-producing organisms. There is also less shrinkage with low temperatures, and the normal life of the fruit is apparently lengthened. The flavor of the fruit improves in cold storage due to the increase of sugars and decrease of acidity. This apparent sugar increase is largely due to the loss of water by

shrinkage, and this change is brought about much more rapidly with the higher temperatures. The shrinkage in weight varies from 5 to 8 per cent in low temperatures to 23 per cent in warm, ventilated storage receptacles.

When fruit was kept six months, there was no apparent tendency to deteriorate rapidly after removal from storage. The best storage temperature proved to be 32°, for at this degree the fruit kept longer and showed less pitting of the skin and actual decay. This pitting is an undesirable feature of cold storage and, although merely a surface blemish manifested in brown sunken areas, renders the fruit unsightly. Of the temperatures employed, 40° seemed to favor the greatest development of this pitted condition.

Markets for American fruits in China, with recommendations for American shippers, C. W. Moomaw and M. L. Franklin (*U. S. Dept. Agr., Dept. Circ. 146 (1920), pp. 27, pl. 1, figs. 9*).—A contribution from the Bureau of Markets relative to the present status of the fruit industry in China and the possible development of markets for certain American fruits in that country. An inspection of the fruit markets in several of the larger Chinese cities revealed an extensive variety of native fruits offered for sale in attractive manner. The authors conclude that the potential market for American fruits in China is large, especially for high-quality apples and certain dried fruits. Emphasis is put, however, upon the need of careful preparation and handling, the utilization of existing trade mediums, and the importance of Japan as a competitor. Statistical data as to Chinese fruit imports are appended.

Popular studies of California wild flowers, B. M. and R. Rice (*San Francisco: Upton Bros. & Delzelle, 1920, pp. 127, figs. 34*).—Historical and descriptive notes are given concerning some of the more abundant and attractive species of wild flowering plants in California. There is also a limited hand-colored edition.

FORESTRY.

Handbook of Nebraska trees, R. J. Pool (*Nebr. Univ., Nebr. Conserv. and Soil Survey Bul. 7 (1919), pp. 171, figs. 516*).—A semitechnical guide to the trees of Nebraska, both indigenous and exotic species. Keys to the genera and species are presented. The greater part of the bulletin is devoted to the description of the different trees, with remarks concerning their distribution and suitability for various purposes. Much of the illustrative material has been derived from the original drawings used in Michigan Trees (E. S. R., 29, p. 43).

Forest and shade trees for planting in Idaho, including a price list for 1921, F. G. Miller (*Idaho Sta. Circ. 16 (1921), pp. 4*).—A revision of Circular 10, previously noted (E. S. R., 43, p. 650).

Forests of Yosemite, Sequoia, and General Grant National Parks, C. L. Hill (*Washington: Dept. Int., Natl. Park Serv., 1920, pp. 40, figs. 22*).—A popular survey of the forest flora of these parks in the central and southern Sierra Nevada.

The flora is predominately of the coniferous type, and, although a large number of species of broadleaf trees occur, these are mostly small and unfit for lumber production. The forests are divided in accordance with elevation into broad belts of characteristic type, and a discussion of the range and environmental adaptation of the more prominent types is given. Descriptions are included of the individual species.

Philippine resins, gums, seed oils, and essential oils, A. P. West and W. H. Brown (*[Philippine] Bur. Forestry Bul. 20 (1920), pp. 230, figs. 73*).—An illustrated survey of trees and other plants of the Philippine Islands yielding these forest products. Certain cultivated plants, such as the coconut palm, peanut, etc., are included for the sake of completeness. The different species

are considered from a botanical standpoint, but emphasis is placed upon the products, their properties and uses.

Twenty-third annual report of the Massachusetts Forestry Association (*Mass. Forestry Assoc. Bul. 130 (1920), pp. 24, figs. 15*).—A popular review of the activities of the association for the year 1920. The text of the new State Forests Law is included. Under its provisions rapid progress in reforestation is forecasted.

Annual reports of the State forester to the State Board of Forest Commissioners for the years ending November 30, 1919, and December 18, 1920, F. E. Pape (*Wash. State Forester Ann. Rpts., 1919–20, pp. 33, pl. 1*).—This report embraces the usual financial and progress reports, paying particular reference to fire protective measures in force and recommendations for rendering this phase of the service more efficient. The use of the aeroplane as a factor in fire detection is briefly discussed. A résumé of the forestry policy adopted by the board December 18, 1920, is included.

Report of the director of the National Park Service to the Secretary of the Interior for the fiscal year ended June 30, 1920, S. T. Mather (*U. S. Dept. Int., Rpt. Dir. Natl. Park Serv., 1920, pp. 423, pls. 34, figs. 5*).—The usual administrative and progress report, along the lines previously noted (E. S. R., 42, p. 539).

Annual report of the director of forestry of the Philippine Islands for the fiscal year ended December 31, 1919, A. F. Fischer (*Philippine Bur. Forestry Ann. Rpt. Dir. Forestry, 1919, pp. 71*).—The usual report for the year's activities of the several divisions of the Philippine Bureau of Forestry, including the customary statistical data. Progress is noted in the reforestation program. Recommendations given in the previous report (E. S. R., 42, p. 539) are repeated.

Forestry, Lord Lovat (*Jour. Roy. Soc. Arts, 69 (1921), No. 3555, pp. 99–113*).—A paper describing the first year's progress in reforestation in Great Britain under the Forestry Commission authorized August 13, 1919. A discussion of the paper is appended.

Forestry, J. G. McDonald (*Rhodesia Resources Com. Rpt. 1921, pp. 107–110*).—A s' ement of the present status of forestry in Rhodesia. The necessity of preservin and developing the very limited timber resources is pointed out, and a list of species used for lumber is included. The recent appointment of a forestry officer is favorably commented upon.

Annual progress report on forest administration in the Province of Bihar and Orissa for the year 1918–19, F. Trafford (*Bihar and Orissa Forest Admin. Ann. Rpt., 1918–19, pp. 111+[74], pl. 1*).—This is the usual annual administrative report (E. S. R., 41, p. 150).

DISEASES OF PLANTS.

Report of fungus diseases for 1919, T. F. Manns (*Peninsula Hort. Soc. [Delaware] Trans., 33 (1920), pp. 79–84*).—Seasonal conditions were very unfavorable to many crops during the year covered by this report. Among those mentioned as suffering severely are wheat, early potatoes, and truck crops (cantaloups, watermelons, squash, pumpkins, and cucumbers).

Tomatoes were severely injured by stem rot or black shank, due to a bacterial organism as yet undetermined. This disease caused losses ranging from 60 to 80 per cent during 1918, and in some cases higher during 1919. An organism was isolated that reproduced the disease symptoms, but not with decisive regularity. The disease appears to remain from year to year in seed beds and to be carried by tools and seeds.

The pea crop was a failure owing to lice, wind-blown sand, and diseases, one of which (soil sickness) is briefly discussed. Pea blight (*Ascochyta pisi*) caused some losses. Streak, due to *Bacillus lathyri* (E. S. R., 29, p. 352), is greatly influenced by the season.

Blossom and twig blight of peach is controlled by removal of the rotten fruit. Peach bacterial shot hole is referred to as increasingly severe. Peach trees also suffered from chilling rains, spray injury, and leaf curl; apple from root rot; sweet potato from stem wilt; and wheat from leaf rust, which was much less severe on bearded varieties.

[Report on plant diseases and insect pests, Wageningen, 1914–15], J. R. Bos (*Meded. Landbouwhoogsch.* [*Wageningen*], *16* (*1919*), *No. 4–5, pp. 105–157*).—This report includes both insect enemies and diseases of plants as dealt with in the Institute of Phytopathology during the period covered by the report.

Plant diseases, H. WELTEN (*Pflanzenkrankheiten. Leipzig: Philipp Reclam, jr., 1919, pp. 199, pls. 5, figs. 76*).—This little book, No. 25 of the Bücher der Naturwissenschaft, is in three main sections, dealing respectively with injurious influences inorganic in character, with injuries due to animals (including man) and plants (chiefly cryptogamic), and more specifically with diseases of grain, beets, potatoes, grapes, and other plants.

Mycology [Travancore, India], N. KUNJAN PILLAI (*Travancore Dept. Agr. and Fisheries Rpt. 1918–19, pp. 6, 7*).—The root disease of the coconut palm is reported to constitute a serious menace in view of the importance locally of the coconut palm. Two types of the disease are briefly described. Treatment of infected trees by cutting out the rotten portion of the cabbage and spraying with Bordeaux mixture resulted in complete recovery when employed in the early stages of the disease, but in no appreciable improvement if postponed beyond a certain stage. Six coconut trees showing bud rot were destroyed.

The Mahali disease of the Areca nut palm was confined to a few trees in North Travancore and was completely suppressed with Bordeaux mixture. A serious fungus disease of cardamom plants is reported as having appeared in one section.

An interesting group of leaf fungi, E. M. DOIDGE (*So. African Jour. Nat. Hist., 1* (*1919*), *No. 2, pp. 164–171, pls. 3*).—A discussion with key is given of 8 species of the Perisporiaceæ and 19 of the Microthyriaceæ as found in South Africa.

Studies on germinability and growth and the influence of Fusarium nivale, G. DERLITZKI (*Untersuchungen über Keimkraft und Triebkraft und über den Einfluss von Fusarium nivale. Diss., Univ. Giessen, 1917, pp. 68, pls. 40*).—This dissertation reports and discusses the results of studies regarding germination and growth of certain plants, mainly cereals, and the effects thereon of *F. nivale* and other parasitic fungi.

An epidemic of Fusarium blight (scab) of wheat and other cereals, A. G. JOHNSON, J. G. DICKSON, and H. JOHANN (*Abs. in Phytopathology, 10* (*1920*), *No. 1, p. 51*).—The authors report an unusually severe epidemic of Fusarium blight or scab on both winter and spring wheat in 1919. Rye, oats, and barley were also said to be attacked. Winter wheat throughout the Mississippi Valley and eastward was universally attacked, and spring wheat when planted in the winter-wheat area was usually infected very heavily. A survey of 15 States and a study of more than 1,000 specimens showed that *Gibberella saubinetii* was the chief causal organism. Less than 1 per cent of the diseased specimens were affected with *Fusarium* spp. The highest infections are said to have occurred where wheat followed corn or wheat in rotation, or where old grass refuse was allowed to accumulate in fence rows and field margins.

Sclerotinia minor n. sp., the cause of a decay of lettuce, celery, and other crops, I. C. JAGGER (*Jour. Agr. Research* [*U. S.*], *20* (*1920*), *No. 4, pp. 331–334, pl. 1, fig. 1*).—A description is given of a decay of lettuce and other plants similar to that produced by *S. libertiana*. This disease is known to occur in Massachusetts, New York, Pennsylvania, and Florida, and is due to *S. minor* n. sp., a technical description of which is given.

Root tumors of beet and kohl-rabi, M. MOLLIARD (*Soc. Path. Veg. France Bul.*, *7* (*1920*), *No. 1, pp. 17–19*).—Root tumors on kohl-rabi from Fontainebleau and on beets from Versailles showed neither Plasmodiophora nor nematodes. A Fusarium in kohl-rabi is thought to be saprophytic only. Considerable analogy to crown gall is noted in certain characters which are described.

Crown wart of alfalfa caused by Urophlyctis alfalfæ, F. R. JONES and C. DRECHSLER (*Jour. Agr. Research* [*U. S.*], *20* (*1920*), *No. 4, pp. 295–324, pls. 10*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the authors give the results of a study on this disease of alfalfa, the investigation having been begun by the senior author in 1917.

The disease caused by the fungus *U. alfalfæ* has been found to have its origin in the infection of very young buds, the foliar elements of which develop into abnormalities not involving the mature structures of root or stem. Infection appears to take place very early in the spring, in northern California being easily discoverable in the latter part of March or early in April. In irrigated regions, or in regions where there is abundant moisture during the entire season, most of the galls reach full development early in the summer and thereafter decay rapidly, only a few surviving until the next spring. The abundant development of the disease in the regions where it occurs is considered associated with excessive moisture during the period when infection is taking place. The application of measures to reduce the moisture near the surface of the soil, it is thought, would reduce the disease.

Fusarium-resistant cabbage, L. R. JONES, J. C. WALKER, and W. B. TISDALE (*Wisconsin Sta. Research Bul. 48* (*1920*), *pp. 3–34, figs. 10*).—In continuation of a previous publication (E. S. R., 34, p. 542), the authors give an account of the advance made both in regard to the study of the disease of cabbage due to *Fusarium conglutinans* and the control measures that have been worked out. Through the study of disease resistance the authors have developed a standard winter storage variety of cabbage, as well as an earlier strain of the same variety and a kraut type that is resistant to cabbage yellows. In cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, work is being carried on with other types of resistant cabbage.

It has been found in all cases that the degree of resistance to Fusarium shown by the strains that have been developed is relative and not absolute. The seedling plants are less resistant than they are after the transplanting stage. So far as tested the strains developed in Wisconsin have proved resistant in other States.

The authors have found that environmental factors, especially soil temperature, influence the development of the disease and the disease resistance of the host. In accordance with the temperature relations, the best results were obtained under Wisconsin conditions by starting even the resistant strains in a noninfected seed bed to avoid possible seedling infection. It is thought probable that in case the resistant strains are propagated through successive generations without repeated selection, they will tend to lose to some extent the disease-resistant character.

The relation of soil temperature and soil moisture to the occurrence of cabbage yellows, W. B. TISDALE (*Abs. in Phytopathology, 10* (*1920*), *No. 1, p. 68*).—As a result of greenhouse experiments it was found that cabbage yellows

does not occur below 17° C. (62.6° F.) or above 34°, and this range compares favorably with the growth of the fungus (*Fusarium conglutinans*) in pure culture. Other experiments conducted with sick soil in which the moisture content was kept constant showed that yellows occurred and developed most rapidly in soil with 19 per cent moisture, and less rapidly as the moisture content was increased.

Correlation of early growth, variation, and productivity of maize as influenced by certain pathologic factors, J. R. Holbert, J. G. Dickson, and H. H. Biggar (*Abs. in Phytopathology, 10 (1920), No. 1, pp. 57, 58*).—Experiments in which alternate hills of corn were inoculated with *Gibberella saubinetii* showed that in the inoculated hills the germination was lowered, early growth retarded, relative vigor and storm resistance reduced, and the average grain production lessened. Plants that were strong or weak in the early stages of growth had a tendency to retain this relative vigor throughout the season. Grain production was directly correlated with rate of early growth and early vigor.

On forms of the hop (Humulus lupulus) resistant to mildew (Sphærotheca humuli), III, E. S. Salmon (*Ann. Appl. Biol., 5 (1919), No. 3-4, pp. 252-260*).—Having noted the apparent immunity or resistance to mildew of certain seedlings of wild hop obtained from Italy, other seedlings of like age and parentage becoming severely infected, the author deals herein with the behavior of the former group and of other seedlings during 1918 and previous years, as partly noted and discussed previously (E. S. R., 43, p. 446).

Summing up the results of this work, he states that the immunity of certain individuals has persisted during three years, other seedlings of the same parentage proving very susceptible. Certain seedlings have appeared persistently immune during four years, both in the greenhouse and in the open. Other seedlings are immune when grown in the greenhouse but susceptible when grown in the hop garden, showing in some cases the highest degree of susceptibility. Still other seedlings are semi-immune to the attacks of the mildew. One seedling of American ancestry grown in the greenhouse was immune throughout the season in 1916 and very susceptible in 1917.

Studies in bacteriosis.—II, A brown blotch disease of cultivated mushrooms, S. G. Paine (*Ann. Appl. Biol., 5 (1919), No. 3-4, pp. 206-219, figs. 5*).—In continuation of these studies (E. S. R., 39, p. 148), a disfiguring disease of mushrooms is discussed. This trouble assumed threatening proportions in a Brentford (Middlesex) nursery soon after April, 1918, but decreased considerably during the latter part of June. The symptoms are said to agree with those of the disease described by Tolaas (E. S. R., 33, p. 446). The cause is said to be a small bacterial organism, possibly a strain of *Pseudomonas fluorescens*, and the name *P. tolaasi* is offered tentatively pending a more complete study of the organism.

Studies in bacteriosis.—III, A bacterial leaf-spot disease of Protea cynaroides, exhibiting a host reaction of possibly bacteriolytic nature, S. G. Paine and H. Stansfield (*Ann. Appl. Biol., 6 (1919), No. 1, pp. 27-39, pl. 1, figs. 4*).—The authors, continuing the series of studies by Paine above noted, describe this disease as having caused considerable disfigurement to leaves of *P. cynaroides* for some years, occurring on leaves of all plants when 10 to 12 in. high and afterwards. It is said to be caused by a parasitic bacterium, for which the name *Pseudomonas proteamaculans* is suggested.

Pathological anatomy of potato blackleg, E. F. Artschwager (*Jour. Agr. Research [U. S.], 20 (1920), No. 4, pp. 325-330, pls. 2, fig. 1*).—Potato plants affected with blackleg are said to show an increase in strongly lignified vas-

cular tissues and a transformation of part or most of the parenchyma cells of cortex and pith into sclereids. Associated with blackleg are protein crystals, especially in the cells of the leaves. Under normal conditions protein crystals, it is claimed, have been observed only in the peripheral cell layers of the cortex of the potato tubers. Only potatoes grown in the arid western parts of Colorado have been studied, the investigation having been carried on by the Bureau of Plant Industry, U. S. Department of Agriculture. It is considered possible that plants grown in the eastern United States and at a lower altitude might not exhibit the anatomical changes reported.

An account of some field observations on the development of potato blight, F. T. Brooks (*New Phytol., 18* (*1919*), *No. 5–6, pp. 187–200, figs. 2*).—This is an account of an attempt by the author, working in connection with A. S. Horne and F. W. Oliver, to ascertain how *Phytophthora infestans* first develops in potato fields planted under ordinary conditions, as bearing upon the problem of the usual mode of overwintering by the blight fungus. The districts chosen as showing development of the fungus in epidemic form without receiving the infection from other districts were the Penzance district and the Isle of Wight, *P. infestans* developing in 1917 in these districts before making its appearance in adjacent parts.

As a result of these observations it is stated that the earliest outbreaks of potato blight developing in a given locality are of strictly limited extent, and that from these the fungus develops centrifugally under favorable conditions until the spores are so widely distributed in the air that infection of susceptible plants becomes universal. The observation that blight affects the tubers at a very early stage in the development of the disease is considered noteworthy, as is also the evidence presented that these do not generally become infected from the main stem through the stolons. The facts observed are considered capable of interpretation either as infection from the soil through the agency of some form of resting body or as infection from blighted shoots growing upward from diseased sets. Related facts are critically discussed.

These observations showed the difficulty of obtaining critical evidence as to the mode in which the blight fungus is carried over from year to year under ordinary conditions.

A copper emulsion as a fungicide, H. and L. K. Wormald (*Ann. Appl. Biol., 5* (*1919*), *No. 3–4, pp. 200–205, pl. 1*).—In 1917 an emulsion of soap with copper sulphate, similar to that prepared by Lees (E. S. R., 40, p. 746), was made and used with potatoes at Wye. The results of tests with preparations more or less modified as to soap and copper content are said to establish the preventive action of the mixture containing 0.4 per cent copper sulphate as regards attacks of the potato blight fungus.

Leafhoppers and hopperburn of potato leaves, J. E. Kotila (*Abs. in Phytopathology, 10* (*1920*), *No. 1, pp. 61, 62*).—Experiments are reported that were conducted in 1919 to ascertain whether or not the tipburn of potato leaves was caused by leafhoppers and to determine if aphids had a similar effect. The results obtained confirmed the conclusion of Ball that the potato leafhopper is responsible for the injury to potato leaves generally known as tipburn, and that this should be designated as hopperburn (E. S. R., 43, p. 655).

The function of sieve tissue, H. M. Quanjer (*Meded. Landbouwhoogsch.* [*Wageningen*], *16* (*1919*), *No. 4–5, pp. 95–104, figs. 5*).—Reviewing results of previous work by himself (E. S. R., 29, p. 347) and others, with deductions therefrom, the author cites evidence considered to prove that leptonecrosis is the chief or sole cause of stoppage of transfer in leaf roll proper. The fact that other causes may exist is not considered to be opposed to the view that

in healthy plants the migration of carbohydrates occurs by way of the sieve tissue.

Potato diseases.—III, Rhizoctonia, A. FRANK (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1921), No. 10, pp. 160–163, figs. 4*).—The author describes the Rhizoctonia disease, which is said to be particularly serious on potatoes in western Washington. For the active control of this disease he recommends sanitation, seed selection and treatment, rotation of crops, soil improvement, and fertilizers.

The influence of soil temperature on the development of potato scab, L. R. JONES and H. H. MCKINNEY (*Abs. in Phytopathology, 10 (1920), No. 1, p. 63*).—Greenhouse cultures with soil temperatures have shown that the optimum for the development of potato tubers is about 21° C. (69.8° F.), while for scab development it is about 24°.

Sulphur experiments for the control of potato scab, W. H. MARTIN (*Abs. in Phytopathology, 10 (1920), No. 1, p. 60*).—Hydrogen-ion concentrations of soil extracts were determined where sulphur was broadcasted at the rate of 300, 400, and 600 lbs. per acre just before planting. At the close of the experiment marked changes in the hydrogen-ion concentration were observed. The untreated plats remained unchanged, while there was an increase in acidity where the sulphur was applied.

Vascular discoloration of Irish potato tubers, H. A. EDSON (*Jour. Agr. Research [U. S.], 20 (1920), No. 4, pp. 277–294*).—The author gives the results of an investigation of vascular discoloration in the stem-end tissues of Irish potato tubers, carried on by the Bureau of Plant Industry, U. S. Department of Agriculture. This work is held to indicate that this vascular discoloration is not proof of the presence of parasitic fungi. Discolored bundles were often found sterile, and fungi were frequently isolated from tissues which appeared normal. A considerable number of species of fungi were isolated from discolored potatoes, and out of 3,203 plantings, all but 161 of which were from discolored tissues, 1,352 gave no growth. Field trials are considered to indicate that neither vascular discoloration nor fungus invasion of the tissues of the mother tuber is a guarantee of disease in the resulting plants, nor is their absence a guarantee of health. The soil and not the tuber is considered the more potent source of disease.

A contribution to the life history and cytology of Synchytrium endobioticum, the cause of potato wart disease, K. M. CURTIS (*New Phytol., 18 (1919), No. 3–4, pp. 90, 91*).—In a brief statement of the results of study continuing for several years regarding the life history and cytology of *S. endobioticum*, the cause of potato wart disease, the author outlines the life history of the organism.

The stage most commonly observed is that of the resting sporangia, one of which, in cases of heavy infection, may occupy each cell of the three or four outermost layers of the tumor tissue. These sporangia continue their development after the decay of the host plant and eventually give rise to numerous uniciliate zoospores. After a period of motility the zoospore enters an epidermal cell of any actively dividing region (eye, stem, or leaf), passes to the lower end of the cell, and there rapidly enlarges, producing a twofold effect on the neighboring cells. The ring of epidermal cells actually in contact with the infected cell grows out to form a rosette-like structure consisting of elongated, curved cells which arch over the parasitized cell at their base. The other cells in the neighborhood divide repeatedly and a somewhat cup-shaped tumor is produced, at the bottom of which lies the infected cell with its rosette. Fresh infection frequently occurs at this stage. The tumor

eventually becomes a spherical mass of tissue with the surface thrown into ridges. The passage of the organism from one host cell to another was never observed.

By the time the parasite has grown sufficiently to fill the lower half of the cell it has developed a firm envelope. The uninucleate contents, surrounded by a thin membrane, now push up through a small area of the free surface of the envelope and pass into the upper half of the host cell. The nucleus divides repeatedly and the extruded mass segments into five to seven portions, each segment being the beginning of a zoosporangium and the whole forming a young sorus. Nuclear divisions continue, and finally the so-called zoospores are formed. When these are nearly mature the sporangia absorb water and swell, the soral envelope and host cell walls are ruptured, and the sporangia are set free on the irregular surface of the tumor.

The motile cells (zoospores) are now liberated, being smaller than the zoospores of the resting sporangium but similar in shape and constituting facultative gametes. Fusion takes place and a zygote is formed when the contents of different sporangia are discharged together, although the gametes may infect the host without such fusion. The result of infection by the zygote (which becomes uninucleate before entry) is a resting sporangium. The result of infection when fusion is omitted is a sorus. A tumor may bear several series of sori before the production of resting sporangia becomes general.

The developmental history of spinach downy mildew, J. ERIKSSON (*Arkiv. Bot., 15 (1918), No. 15, pp. 1–25, pls. 4, figs. 3; abs. in Internatl Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 10 (1919), No. 3, p. 357*).—Besides an account of the geographical distribution of the fungus *Peronospora spinaciæ*, causing spinach mildew, the author discusses its classification, external appearance, overwintering, developmental phases (including a plasma stage), and control, mainly by use of healthy seed.

Spacing tomato plants for field spraying, C. E. TEMPLE (*Abs. in Phytopathology, 10 (1920), No. 1, p. 59*).—As a result of experiments extending over four years, the author claims that rows of tomato plants should be approximately 6 ft. apart in order to spray with large machinery without great loss from mechanical injury to the plants The plants may be set close enough in the row to obtain the usual number per acre without loss from overcrowding. The most desirable spacing in Maryland for spraying purposes is said to be 3 by 6 ft.

Tomato-spraying experiments for the control of Septoria, C. E. TEMPLE (*Abs. in Phytopathology, 10 (1920), No. 1, p. 60*).—Extensive spraying experiments are reported upon in which more than 200 acres of tomatoes were divided into plats and both liquid and dust sprays applied by traction or gasoline engine machines. A large number of spray formulas were tested, but the bluestone liquid sprays, both with and without rosin oil soap, were the most promising.

A stem disease of tomato caused by Macrosporium solani, J. ROSENBAUM (*Abs. in Phytopathology, 10 (1920), No. 1, p. 59*).—The author reports a stem disease of tomato plants which did considerable damage in 1919 in Delaware. Plants of all ages were affected, the stems at the point where they emerge from the surface of the soil being dark brown, shriveled, and presenting a girdled effect. From diseased tissue the author isolated a fungus belonging to the genus Macrosporium, which in all its essential characters resembles *M. solani* from potatoes.

Studies in bacteriosis.—IV, Stripe disease of tomato, S. G. PAINE and W. F. BEWLEY (*Ann. Appl. Biol., 6 (1919), No. 2–3, pp. 183–202, pls. 2, figs. 5*).—Continuing the studies noted on page 644, the authors describe a disease attacking

in varying degrees different varieties of tomatoes grown under glass, and supposedly due to *Bacillus lathyri*. Susceptibility is increased by nitrogen and decreased by potash in the soil.

Field tests with strains of wilt-resistant tomato seed in 1919, J. A. McClintock (*Abs. in Phytopathology, 10 (1920), No. 1, p. 59*).—The author reports that strains of seed from wilt-resistant tomatoes from different sources, when tested on heavily infested soil at the Georgia Experiment Station, showed that no strain was sufficiently resistant to grow throughout the summer. Strains of commercial peppers and eggplants grew and fruited throughout the summer on the same infested soil.

A Phytophthora rot of pears and apples, H. Wormald (*Ann. Appl. Biol., 6 (1919), No. 2–3, pp. 89–100, pl. 1, figs. 2*).—A study of a soft rot causing fruit fall of apples and pears is described. The causal organism is *P. cactorum*.

Results of spraying the apple for blotch in Ohio in 1919, W. G. Stover, F. H. Beach, and T. H. Parks (*Abs. in Phytopathology, 10 (1920), No. 1, p. 58*).—Three applications of Bordeaux mixture in 1919, followed by an additional application in July, are said to have given an average of over 90 per cent of marketable fruit. Unsprayed trees in the same orchards yielded less than 10 per cent of marketable fruit. Sprayed trees not only bore more fruit, but the apples were larger as a rule than those from unsprayed trees.

Brown rot of apricots, W. L. Howard and W. T. Horne (*California Sta. Bul. 326 (1921), pp. 71–88, figs. 6*).—A description is given of the brown-rot fungus (*Sclerotinia cinerea*), which affects the ripening fruit and the twigs of the apricot. As the attack on the twigs is considered more serious, particular attention is paid to this phase of the investigation. The twigs become infected through the fungus attacking the withering flowers, and not only are the blossoms and young fruits killed, but also the twigs to a distance of several inches.

Based on experiments and observations as to the best method of treating the disease, it is recommended that a thorough cleaning out of all blighted twigs and all rotted fruits be made, followed by thorough spraying. Experiments begun in February, 1920, in which 16 different spray treatments were tested, gave such satisfactory results that it was concluded that apricot blossoms may be effectively protected from brown rot by spraying the trees once before they come into bloom with either lime sulphur or Bordeaux mixture. The best results followed spraying when the buds were considerably swollen, although excellent control was secured by spraying at the time the trees were coming into bloom. No evidence was secured to show that spraying apricot trees before the buds begin to swell affords any protection against the disease.

Blossom blight of the peach, M. T. Cook (*Abs. in Phytopathology, 10 (1920), No. 1, pp. 64, 65*).—This disease of peach, due to *Sclerotinia cinerea*, was reported as more severe in 1919 than usual, the crop in some cases being practically destroyed. The disease was much less severe on young than old orchards, and no apparent connection between the fungus and mummified fruit was found, nor was there any correlation with its occurrence on different varieties. The organism is considered to have spread from cankers on the 1918 wood, and these are believed to be a very important source for the spread of the organism. It is thought doubtful whether many of the cankers give off spores for more than one season, and an important factor in control consists in preventing the formation of cankers. This can be done, it is claimed, by more frequent and more thorough spraying.

A heart rot of peach, W. A. McCubbin (*Abs. in Phytopathology, 10 (1920), No. 1, p. 65*).—The author reports a rot of the heartwood of living peach caused by *Coriolus versicolor*. It is believed that the fungus most readily attacks wood injured by winter conditions.

Cryptogamic diseases of grape [1917–18], C. GODET (*Ann. Agr. Suisse, 20 (1919), No. 1, pp. 5, 6*).—As a consequence of the dryness of the season, comparatively little injury was caused by the grape downy mildew, Oidium, and gray rot. Brief accounts are given of control measures as applied to the first two of these diseases.

Experiments in grape downy mildew control, C. GODET (*Ann. Agr. Suisse, 20 (1919), No. 1, pp. 27–32*).—This is a more detailed account than that noted above regarding control of grape downy mildew.

A new parasite of grape, A. PUTTEMANS (*Soc. Path. Veg. France Bul., 7 (1920), No. 1, pp. 34–36, fig. 1*).—The grape variety Isabelle (*Vitis labrusca*) shows at points named in Brazil the disease which is here briefly characterized and thought to be due to lack of balance in development. The grapes grow rapidly without corresponding growth of the stalk or pedicel. The trouble appears in the interior of the clusters. Climatic peculiarities may be primary factors.

Two parasites of wild fig, J. COTTE (*Soc. Path. Veg. France Bul., 7 (1920), No. 1, pp. 26–30, figs. 2*).—Two animal parasites of wild fig are described as new species under the names *Tylenchus sycobius* and *Eriophyes ficus*.

A root disease of cacao in Trinidad, W. NOWELL and W. G. FREEMAN (*Dept. Agr. Trinidad and Tobago Bul., 18 (1919), No. 4, pp. 178–199, pls. 3, figs. 2*).—A root disease of cacao as here discussed is said to be due ordinarily to *Rosellinia pepo*, being communicated from the roots of dead or dying shade trees, especially breadfruit, avocado, and pois-doux. An unidentified species may attack cacao in certain localities.

An infected tree may be killed gradually by the progressive investment of the roots, or rather quickly by the destruction of the bark around the collar, as the fungus penetrates both bark and wood. It is said that much can be done to prevent outbreaks of the disease by measures giving wind and sun access to the soil, the bases of the trees, and any logs or other dead material. Treatment by excision and exposure is successful in the early stages of infection, in which detection is difficult. It is suggested that infected trees be flamed and removed and the soil freed from any remaining portions and limed. Adjacent trees should be isolated by trenches.

Influence of temperature and humidity on the growth of Pseudomonas citri and its host plants and on infection and development of the disease, G. L. PELTIER (*Jour. Agr. Research [U. S.], 20 (1920), No. 6, pp. 447–506, fig. 1*).—In a contribution from the Alabama Experiment Station the author gives the results of a study in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, of the effect of temperature and humidity on the development of citrus canker. With the time factor included, the minimum temperature for growth in culture for *P. citri* is about 5° C. (41° F.), the optimum between 20 and 30°, the maximum about 35° for a period of 24 hours, and a thermal death point between 49 and 52°.

The influence of humidity on the viability of the organism is said to be very distinct and is closely associated with temperature. The citrus plants used in greenhouse experiments were found to vary markedly in their reaction to temperature and humidity, especially at low and high temperatures. However, with the time factor included, the optimum temperature for all the plants used was found to lie between 20 and 30° C., and with slight variations the same temperature relations were found to hold in the field.

Three conditions are said to be essential for infection—the presence of free moisture on the plant, a suitable temperature, and an actively growing plant. The life of the organism in culture and outside the host plant is said to be

ruled by an entirely different set of conditions from those which control it when it is parasitically active in the host plant. Likewise, the conditions necessary for initial infection of the plant were found to differ. The conditions which bring about the most active growth of the host plant are also responsible for the most rapid development of the disease. The organism is said to be active in the tissues so long as the host cells are active, and when the plant is forced into dormancy the organism becomes inactive and the disease is then quiescent.

The results of this investigation are held to indicate that it will be necessary to study the behavior of the host plant in its environment and its relation to the causal organism before any scientific selection or breeding for disease resistance can be made.

Report on [citrus canker] eradication work [in Florida] in cooperation with the Bureau of Plant Industry, for quarter ending June 30, 1920 (*Fla. Plant Bd. Quart. Bul., 4* (*1920*), *No. 4, pp. 118, 119*).—The present issue of this report (E. S. R., 36, p. 352) shows that citrus canker has been found in 22 Florida counties, infecting since May, 1914, 13,727 grove trees and 342,254 nursery trees on 481 properties. Two of these properties are still classed as infected and 479 as no longer danger centers. No grove trees have been found to be infected with the canker since August, 1919, when one infection was recorded. The tabulation of tree infections, covering every month since May, 1914, shows minimal infection in January and February and maximal infection in spring and summer until 1919, when eradication was apparently completed.

Black crust of Brazil nuts, E. R. Spencer (*Abs. in Phytopathology, 10* (*1920*), *No. 1, p. 61*).—A brief description is given of a fungus disease of Brazil nuts in which the kernel is covered by a black mycelium, which destroys the outer cell layers.

Diseases of forest and grove trees, F. W. Neger (*Die Krankheiten Unserer Waldbäume und Wichtigsten Gartengehölze. Stuttgart: Ferdinand Enke, 1919, pp. VIII+286, figs. 234*).—This account, regarding the nature and effects of disease and abnormality in forest and grove trees as due to parasitic or other causation, is in two main parts, dealing respectively with nonparasitic and with parasitic agencies. An appendix lists in alphabetical order the trees parasitized, and gives brief description of the different diseases in connection with the causal organisms.

Hypertrophied lenticels on the roots of conifers and their relation to moisture and aeration, G. C. Hahn, C. Hartley, and A. S. Rhoads (*Jour. Agr. Research* [*U. S.*], *20* (*1920*), *No. 4, pp. 253–266, pls. 3*).—The authors report observing warty excrescences upon the roots of coniferous seedling stock at the Bessey Nursery of the Forest Service, U. S. Department of Agriculture, at Halsey, Nebr. These were found on all species of pines grown, and were so abundant on the yellow pine (*Pinus ponderosa*) that the possibility of a parasite as a causal agent was suggested. Attempts were made by the authors to obtain evidence of a pathogenic organism, but always with negative results. After the failure to obtain evidence of this character, a histological examination was made, which showed the excrescences had the structure of the hypertrophied lenticels so commonly seen in many dicotyledonous plants. They are produced in various kinds of soil in the presence of excessive moisture and may occur on either weak or vigorous plants. Hypertrophy was found to be decreased by top pruning and was increased by root injury.

The authors claim that the conclusions of other authors that excessive soil moisture stimulates lenticel hypertrophy through increasing general sap pressure and that oxygen hunger is of no importance as a stimulus are not supported by the evidence obtained by them through experiments with conifers.

Oak Oïdium in Brazil, A. PUTTEMANS (*Soc. Path. Veg. France Bul., 7 (1920), No. 1, pp. 37–40*).—Facts cited indicate that oak Oïdium (*Microsphæra quercina*) appeared in Brazil in 1912, six years after its outbreak in Europe. The question is discussed as to the mode of its transference.

Wood-destroying fungi in pulp and paper mill roofs, R. J. BLAIR (*Abs. in Phytopathology, 10 (1920), No. 1, p. 61*).—Attention is called to the rapid rotting which often takes place in the roofs of paper and pulp mills due to species of fungi, the most common of which are said to be *Lentodium tigrinum, Lenzites trabeum,* and *Poria xantha.*

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Pisgah National Game Preserve, regulations and information for the public (*U. S. Dept. Agr., Dept. Circ. 161 (1921), pp. 11*).—This pamphlet contains regulations prescribed by the Secretary of Agriculture governing hunting, fishing, and camping on the Pisgah National Game Preserve, North Carolina, together with instructions for applying the regulations and information intended to aid the public in making proper use of this 90,000-acre preserve.

Description of a new species of beach mouse from Florida, A. H. HOWELL (*Jour. Mammalogy, 1 (1920), No. 5, pp. 237–240, fig. 1*).

A geographical bibliography of British ornithology from the earliest times to the end of 1918, W. H. MULLENS, H. K. SWANN, and F. C. R. JOURDAIN (*London: Witherby & Co., 1919, pt. 1, pp. 1–96; 1920, pts. 2, pp. 97–192; 3, pp. 193–288; 4, pp. 289–384; 5, pp. 385–480; 6, pp. VIII+481–558*).—This bibliography, arranged by counties, lists books, articles, notes, and records relating to ornithology in Great Britain.

[Control of insects by lizards in Porto Rico], E. G. SMYTH (*Rev. Agr. Puerto Rico, 4 (1920), No. 5, pp. 11–21*).—This paper deals with lizards of the genus Anolis, which represent over 75 per cent of the number of individual lizards occurring in Porto Rico. Being exclusively insect feeders, they are important enemies of the worst insect enemies of crops. The more common and valuable insect-destroying species of the island are the striped lizard (*A. pulchellus*), the common lizard (*A. cristatellus*), the saddle-spotted lizard (*A. stratulus*), the green lizard (*A. evermanni*), the giant lizard (*A. cuvieri*), and the ground lizard (*Ameiva exul*).

Mention is also made of the importance of tree toads (*Eleutherodactylus* spp.) as insect destroyers.

Petroleum insecticides, R. K. VICKERY (*Jour. Econ. Ent., 13 (1920), No. 6, pp. 444–447*).—This is a brief discussion of the subject, in which a few observations and experiments are recorded.

Combined Bordeaux oil emulsion spray, C. A. MACRUM (*Better Fruit, 14 (1920), No. 8, pp. 9, 39*).—This is based upon the account previously noted (E. S. R., 42, p. 153).

Nicotin sulphate in a dust carrier against truck-crop insects, R. E. CAMPBELL (*U. S. Dept. Agr., Dept. Circ. 154 (1921), pp. 15, figs. 5*).—The successful use of nicotin sulphate in dust form by Smith in the control of the walnut aphis (*Chromaphis juglandicola* Kalt.) in California, previously noted (E. S. R., 41, p. 457), led the author to test its effectiveness on truck-crop insects.

The effect of the dust, which consists of a mixture of 2 per cent by weight of 40 per cent nicotin sulphate in kaolin (25 per cent of pulverized unslaked lime having been added), on insects and mites is similar to that of the nicotin sulphate in liquid spray, except that it is much more rapid. The work soon showed, however, that while the walnut aphis was easy to kill with a 2 per cent

strength, a higher strength was required for practically all other aphids. For use against the melon aphis in commercial practice, a 5 to 7.5 per cent strength of nicotin sulphate gave the best results. It was found that with a hand-operated bellows duster a man can cover not less than 2 acres of full-grown cassabas or muskmelons a day, using about 50 lbs. of dust per acre, costing 12 cts. a pound for 5 per cent strength and 15 cts. for the 7.5 per cent.

In work with the cabbage aphis it was found that for ordinary commercial purposes a 5 per cent strength of the dust was the most satisfactory. With a commercial sprayer it was possible to cover 3 or 4 acres per day at an average cost of $12 per acre, including rent of the machine and team. The percentage of aphids killed was low, not averaging over 70 per cent for the entire field, whereas an average kill of 90 per cent or over was easily obtained with the dust when carefully applied.

In the use of the dust against onion thrips, from 87 to 97 per cent were killed. A trial on a commercial scale, using the hand-operated bellows duster, shows that one man could cover from 2.5 to 3 acres a day, using from 40 to 50 lbs. per acre, at a total cost, including labor at $3.50 per day, of from $6 to $7 per acre.

Experiments with the pea aphis have shown it to be much more resistant to the action of nicotin dust than any other aphid upon which it had been tested. Low percentages failed to kill the aphids, but good results were obtained by a 10 per cent strength when carefully applied. The results indicate that with the present cost of the 6 per cent dust at 20 cts. a pound, it would be impracticable to use it against the pea aphis, except on sweet peas. Adult cucumber beetles (*Diabrotica soror* Lec. and *D. trivittata* Mannh.) were killed by a 10 per cent strength.

It is pointed out that this dust can be combined with arsenate of lead or sulphur for combating different types of insects, or for insect and fungus diseases. Its disadvantages are loss of strength when held long in open containers, and that it can not be combined with Bordeaux mixture, except when the latter is dry.

[Report of the] department of entomology, H. C. Severin (*South Dakota Sta. Rpt. 1920, pp. 27–31*).—Three Adams fund projects conducted during the year are briefly reported upon, of which those relating to the web-spinning sawfly, *Neurotoma inconspicua* (Nor.), and the common field cricket, *Gryllus abbreviatus* Serv., were in continuation of the work previously noted (E. S. R., 42, p. 850). A recent bulletin reporting upon the investigation of *N. inconspicua* has been noted (E. S. R., 44, p. 555).

Satisfactory progress was made in the work with *G. abbreviatus*, which is a source of injury to alfalfa seed pods, alfalfa seed, uncut grain, shocked grain, binder twine, and goods made of paper and cloth. Two egg parasites were discovered, namely, *Ceratoteleia marlatti* Ashm. and *Paridris* n. sp., and the tachinid *Exoristoides johnsoni* Coq. was reared from the adult cricket. Control measures recommended include plowing or disking and harrowing the fields where injury was experienced during the year, the use of poison bait, etc.

The third project reported upon is that of the wheat stem maggot, *Meromyza americana* Fitch, which causes loss ranging from less than 1 up to 15 per cent or more in wheat fields and from less than 1 up to 4 per cent or more in barley fields, while oat fields suffered but little. Two parasites, *Microbracon meromyzæ* Gah. and *Cœlinidea meromyzæ* Forbes, were reared from *M. americana*, and *Pediculoides ventricosus* was discovered feeding upon the larvæ, as was an unidentified mite which attacks the adult. A poison bait spray for destruction of the flies was used in some indoor work with good results.

Synopsis report of the Dominion entomological branch in British Columbia, R. C. Treherne (*Brit. Columbia Dept. Agr. Ann. Rpt., 14 (1919), pp. 49–53*).—Included in this report are accounts of the occurrence of and injury caused by the peach twig-moth, the rose leafhopper (*Empoa rosæ*), etc., studies of fruit worms, fire-blight distributers, insect enemies of small fruit, vegetables, and forage crops and grain.

Proceedings of the Entomological Society of British Columbia (*Ent. Soc. Brit. Columbia, Proc., Econ. Ser., No. 11 (1920), pp. 91–107, fig. 1*).—These proceedings are in continuation of the Economic Series previously noted (E. S. R., 37, p. 459), including the following papers: The Onion Maggot, by R. C. Treherne and M. H. Ruhman (pp. 91–94); Observations on the Control of the Onion Maggot (*Hylemyia antigua*), by M. H. Ruhman (pp. 94–97); Some Notes on the Tent Caterpillar, by A. B. Baird (pp. 97–100); Further Notes on the Tent Caterpillar and its Natural Control, 1919, by A. B. Baird (pp. 101, 102); Observations on the Use of Poison Baits for the Control of Cutworms in 1918, by M. H. Ruhman (pp. 102–104); and General Records of Work Carried on in the United States and Canada in 1918, by R. C. Treherne (pp. 104–107).

Proceedings of the Entomological Society of British Columbia (*Ent. Soc. Brit. Columbia, Proc., System. Ser., No. 12 (1918), pp. 39, pls. 2, figs. 26*).—The papers here presented are chiefly of systematic interest, but include the following: Life History of the Leaf-eating Crane Fly (*Cylindrotoma splendens* Doane), by A. E. Cameron (pp. 9–12), previously noted from another source (E. S. R., 40, p. 169); Life History of *Perigrapha præses* Grt., by G. O. Day (pp. 17–19); Natural Control Investigations in British Columbia, by J. D. Tothill (pp. 37–39); and Notes on the Aeolothripidæ, by R. C. Treherne (pp. 27–33).

Insects of economic importance in the Cape Region of Lower California, Mexico, G. F. Ferris (*Jour. Econ. Ent., 13 (1920), No. 6, pp. 463–467*).—The author briefly discusses the Cape Region of Lower California, including characteristics of the agriculture, and presents notes on the insects of economic importance.

[The more important animal pests of the more common vegetables in Austria], B. Wahl (*Mitt. K. K. Landw. Bakt. u. Pflanzenschutzstat. [No. 106 (1920)], pp. 70, figs. 20; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 7, p. 261*).—An account is given of the more important insect enemies of vegetables and the damage caused by them, with the remedial measures recommended.

Combating insect pests, J. F. Illingworth (*Aust. Sugar Jour., 12 (1920), No. 7, pp. 395, 397, 399, 401*).—The author reports upon the establishment of the tachinid *Ceromasia sphenophori* Vill. in the Babinda area; work with *Lepidiota albohirta* (greybacks) and the linear bug (*Phænacantha australica* Kirkaldy), a new pest of cane which is abundant in many fields; and natural enemies of cane grubs.

Insects found on tobacco in New South Wales, W. W. Froggatt (*Agr. Gaz. N. S. Wales, 31 (1920), No. 10, pp. 714–716, pls. 3*).—The pests here mentioned as a source of injury to tobacco in New South Wales are the potato tuber worm or tobacco splitworm (*Phthorimæa operculella*), the Rutherglen bug (*Nysius vinitor*), the green leaf jassid, the mottled-winged tobacco bug (*Dicyphus tabaci*), and a small green tobacco bug.

War against tropical disease, A. Balfour (*London: Wellcome Bur. Sci. Research, 1920, pp. 219, pl. 1, figs. 180*).—This work includes much information on insects in their relation to disease transmission. This is presented under the following headings: Some aspects of tropical sanitation (pp. 17–36), tropical problems in the new world (pp. 37–70), the medical entomology of Salonica

(pp. 81–98), sanitary and insanitary makeshifts in the eastern war areas (pp. 99–142), and the palm from a sanitary standpoint (pp. 196–219).

The pear thrips, E. O. Essig (*California Sta. Circ. 223* (*1920*), *pp. 9, figs. 3*).—This is a popular summary of information on the pear thrips and means for its control. Studies of this pest in California by Foster and Jones have been noted (E. S. R., 32, p. 850).

Studies on the life history and habits of the beet leafhopper, C. F. Stahl (*Jour. Agr. Research* [*U. S.*], *20* (*1920*), *No. 4, pp. 245–252, pls. 2*).—This is a brief summary of observations made during the past few years at Jerome, Idaho, and in the sugar-beet growing regions of California.

One generation only was observed in southern Idaho, while from two to four were observed under California conditions. A maximum of 247 eggs was obtained from a single female. The incubation period covered from 10 to 15 days during the height of the egg-laying season, and the nymphal period from 25 to 52 days.

"In southern Idaho the beet leafhopper appears in the beet fields in June and starts reproducing at once, oviposition continuing throughout the season. After harvest the leafhoppers enter a true hibernation period. In California the adults appear in the beet fields soon after April 1 and remain until harvest time, when they disperse to wild vegetation suitable for food and protection. No true hibernation was noted in California."

Three species of egg parasites were reared from the beet leafhopper, viz, *Polynema eutettixi* Gir., *Abbella subflava* Gir., and *Anagrus giraulti* Cwfd., the first two of which are very effective. Two species of the dipterous family Pipunculidæ were reared as parasites of the nymphs and adults of the beet leafhopper, viz, *Pipunculus industrius* Knab and *P. vagabundus* Knab, the first of which is quite effective. Dryinid parasites were reared, but are not very efficient.

Leaf-stem gall aphis of the poplar, D. Miller (*New Zeal. Jour. Agr., 21* (*1920*), *No. 3, pp. 134, 135, figs. 2*).—This records the infestation of leaf petioles of poplar trees in central Otago by *Pemphigus populi-transversus* Riley.

Protection of vineyards from phylloxera, F. T. Bioletti (*California Sta. Circ. 226* (*1920*), *pp. 4*).—The author here discusses the means of dispersal of the phylloxera, quarantine, probability of infestation, resistant vines, when to use resistant vines, need for skill and experience, and the best resistant stocks.

Results of washing experiments for control of the European elm scale, F. B. Herbert (*Jour. Econ. Ent., 13* (*1920*), *No. 6, pp. 471–475*).—Experiments conducted have led the author to conclude that the European elm scale can be treated very satisfactorily with a garden hose and nozzle and an average force of water.

Control of the brown apricot scale and the Italian pear scale on deciduous fruit trees, E. O. Essig (*California Sta. Circ. 224* (*1920*), *pp. 11, figs. 5*).—In this circular the author first briefly describes the characteristics of the brown apricot scale, or European fruit lecanium (*Lecanium corni* Bouché), and the Italian pear scale (*Epidiaspis piricola* Del G.) separately, and then discusses the control measures for both together.

Winterkilling of the San José scale, A. Spuler (*Jour. Econ. Ent., 13* (*1920*), *No. 6, pp. 443, 444*).—Records of winterkilling kept during the winter of 1919–20 at seven localities in the State of Washington show a range of from all dead at Prosser, where the minimum temperature was —30° F., down to 80.8 per cent dead at Spokane, where the temperature was —15°. "In contrast . . . is the average percentage of winterkill of the San José scale for the past 10 years, not including the winter of 1919–20, for the following localities:

Clarkston, 19 per cent; Walla Walla, 24 per cent; Yakima, 32 per cent; and Wenatchee, 40 per cent."

Daylight orchard fumigation, R. S. WOGLUM and M. B. ROUNDS (*Jour. Econ. Ent., 13 (1920), No. 6, pp. 476–485*).—"The writers have carried on experimental daylight fumigation with liquid hydrocyanic acid from the middle of the active fumigation season in October throughout the winter period. As a result of this work they are convinced that, where practicable, daylight winter fumigation is preferable to night work. At this period the insects are especially difficult to kill on cool nights. Furthermore, the trees are in a dormant condition and can withstand a stronger gas even at temperatures approximating 80° F. Particular attention should be given to the exposure.

"While the data accumulated during the past season shows that an experienced and careful operator with a few tents can by constant manipulation of dosage and exposure practice daylight work during the growing season, especially on lemons, with partial success, such practice in preference to night work can not be recommended at the present time. Experience has proved that fixed dosages and exposures are the safest guides to effective fumigation, and the necessary data have not yet been accumulated to establish this condition for daylight summer and autumn work. In fact there is considerable doubt if a fixed dosage-exposure combination can be developed which is practical under the extreme varieties of daylight weather during the usual fumigation season, a situation which is further emphasized by the widely differing conditions between the hot interior valleys and the cooler, more humid coastal belt."

A dipterous parasite of the parsnip webworm (Depressaria heracliana L.), M. D. LEONARD (*Jour. Econ. Ent., 13 (1920), No. 6, pp. 491, 492*).—The author records the rearing of the tachinid fly *Dichætoneura leucoptera* John. from *D. heracliana* pupæ at Pleasant Valley, N. Y.

A study of the effect of cotton worm on boll development and cotton yield, F. L. THOMAS (*Jour. Econ. Ent., 13 (1920), No. 6, pp. 489–491*).—"The loss of foliage from ravages by cotton worms does not kill the cotton plants. Stripping by cotton worms results in the much earlier maturity of unopened bolls. There is practically no loss in weight of bolls maturing on plants without foliage.

"With a killing frost occurring normally at an average date of November 10 for this locality, after which development ceases, the following conclusion is drawn: Under boll-weevil conditions and years of abundant moisture, stripping of rank growing cotton two months before a killing frost is beneficial rather than injurious. This conclusion is contrary to the general opinion regarding cotton worm injury, and the following question is therefore raised: What relation does the date of stripping bear to the amount of injury produced?"

Combating the sugar beet webworm on a large scale, A. C. MAXSON (*Jour. Econ. Ent., 13 (1920), No. 6, pp. 468–471*).—This is a discussion of work conducted during an outbreak of the sugar beet webworm (*Loxostege sticticalis* L.) in the Rocky Mountain and intermountain States during the growing season of 1919, which outbreak of the pest far exceeded any previous outbreak. Of the insecticides tested, Paris green, used at the rate of 3.5 to 4 lbs. per acre, gave by far the quickest and best results.

An index number for rating codling moth treatments, A. L. MELANDER (*Jour. Econ. Ent., 13 (1920), No. 6, pp. 456–459*).—What the author considers a more exact method of comparing the results of sprayings is briefly described.

"Inasmuch as a wormy apple shows that the codling moth spray was in that instance ineffective, but a sting [spot resulting from the nibbling of a

codling worm that died on its way into the apple] usually indicates that the spray accomplished its purpose, we have in the ratio of worms to stings a simple and ready index to judge the merits of the particular treatment. Relatively the more stings there are the better the treatment has proved. It is much easier to express and compare treatments in terms of such index numbers than to keep in mind a series of variable factors, like the previous history and present contamination of the trees, when interpreting results."

Winterkilling of codling moth larvæ, E. J. Newcomer (*Jour. Econ. Ent.*, *13* (*1920*), *No. 6*, *pp. 441, 442*).—In examinations of larvæ made in the State of Washington from December 23 to February 28, it was found that wherever the minimum temperature had been below —25° F. all larvæ with no protection other than bark or burlap bands were killed.

Report of the pink bollworm of cotton (Pectinophora gossypiella Saund.), E. E. Scholl (*Tex. Dept. Agr. Bul. 65* (*1919*), *pp. VIII+459, figs. 77*).—This is a general discussion of the present status of knowledge of *P. gossypiella* and of its introduction into the United States, with details relating to the eradication work that has been conducted. Quotations from a bulletin on the pest by Hunter (E. S. R., 39, p. 764), an account by Busck (E. S. R., 37, p. 564), and other sources are included. A list is given of important cotton insects and their principal characteristics. The text of the Federal Plant Quarantine Act, Federal rules and regulations pertaining to the pink bollworm, amendments, notices of quarantine and regulations, correspondence relating to the act, proclamations by the Governor of Texas, etc., are included. Classified lists of the literature covering 15 pages are given, as well as an index to the subject matter.

A new apple pest in Pennsylvania, S. W. Frost (*Jour. Econ. Ent.*, *13* (*1920*), *No. 6*, *p. 492*).—*Eulia velutinana* Walk., which the author refers to as the two-banded leaf roller, has become a serious enemy of the apple in southern Pennsylvania.

A new tortricid moth from Nova Scotia (Lepidoptera), A. Busck (*Canad. Ent.*, *52* (*1920*), *No. 6–7*, *p. 125*).—*Cacœcia hewittiana*, reared in large numbers from raspberry from Sydney, N. S., is described as new.

Further experiments with Anopheles plumbeus Stephens; its infection with P. falciparum in England; also notes on the apparatus and technique employed, B. Blacklock and H. F. Carter (*Ann. Trop. Med. and Parasitol.*, *14* (*1920*), *No. 2*, *pp. 275–282*, *pl. 1*).—"Of 12 females of *A. plumbeus* fed once on one or other of two cases of simple tertian malaria (*P. vivax*), and subsequently kept at room temperature (maximum 22° C., minimum 13°), none became infected. Of 12 females of *A. plumbeus* fed once on a case of malignant tertian malaria (*P. falciparum*), and subsequently kept at 28°, none lived longer than 8 days after the infected feed; one contained oöcysts in the mid-gut."

Filariasis in southern United States, E. Francis (*Pub. Health Serv. U. S.*, *Hyg. Lab. Bul. 117* (*1919*), *pp. 36*, *pls. 10*).—The second part of this paper relates to the determination of the mosquito carrier at Charleston (pp. 22–30), the third part to the prevention of spread of filariasis (p. 31), and the fourth part to the anatomy of the proboscis in relation to filaria transmission (pp. 32–34). Mosquito dissections resulted in the finding of a high percentage of *Culex fatigans* infected with *Filaria bancrofti* and the finding of all *Ædes calopus* negative for that infection, thus showing conclusively that *C. fatigans* is a transmitter of *F. bancrofti*, and that its constant associate, *A. calopus*, is incapable of such transmission.

The behavior of Fundulus heteroclitus on the salt marshes of New Jersey, F. E. Chidester (*Amer. Nat.*, *54* (*1920*), *No. 635*, *pp. 551–557*).—This re-

lates to studies of a predatory fish enemy of the salt-marsh mosquitoes in northern waters, made by the author near New Brunswick, N. J., in 1914–15 while acting as consulting zoologist to the department of entomology of the New Jersey Stations.

"Field studies of *F. heteroclitus* were made throughout one entire year on the salt marshes of New Jersey. Spring migration begins in March and is probably caused by several factors, including the higher temperature of the inland water; currents due to high tides and rainfall; the need for food available in fresh water; greater metabolic activity due to gonad development, which demands a greater oxygen supply. Summer activities consist in spawning, feeding, lazy movements from the marshes to the brackish water and back again. In the autumn migration is less constant and the larger fish are less numerous. In the winter migration ceases entirely as the marsh pools are scumming with ice. Some landlocked individuals burrow into the mud of permanent pools, coming out occasionally as the sun warms the water. Many fish are killed by the cold as they remain in temporary pools with bottoms composed of caked mud and grass offering no shelter. The majority of *F. heteroclitus* return to salt water in the winter probably remaining near the mouths of rivers until spring."

The Hessian fly and its control, L. HASEMAN (*Missouri Agr. Col. Ext. Circ. 80 (1920), pp. 4, fig. 1*).—This brief popular account includes a map showing fly-free dates for Missouri.

Catalogue of the Coleoptera of America, north of Mexico, C. W. LENG (*Mount Vernon, N. Y.: J. D. Sherman, jr., 1920, pp. X+470, pl. 1*).—This catalogue enumerates systematically all the species of Coleoptera described prior to January 1, 1919, which occur in North America, north of Mexico, and including Greenland, with consecutive numbers, synonyms, citations of the original description, and an indication of distribution. An effort has been made to arrange the species in genera, tribes, families, superfamilies, and series in accordance with the most recent works on classification, but an explanation of the difficulty of doing so in a satisfactory manner is presented in the introduction. No attempt has been made to determine the validity of the numerous specific names proposed by recent authors. Numbered names indicate species described and unquestioned in print, while names proposed by one author and disputed by another are usually unnumbered, but are sometimes treated as varieties, while synonyms are always unnumbered. The author acknowledges the aid received from specialists, particularly E. A. Schwarz.

The catalogue proper, which lists some 18,547 species, is followed by a Catalogue of the North American Coleoptera Described as Fossils, by H. F. Wickham (pp. 347–365), a bibliography of 78 pages, and an index to the genera, etc.

The green Baris, an enemy of cabbage in France, L. BILLAUDELLE (*Rev. Hort. [Paris], 92 (1920), No. 9, pp. 162, 163, fig. 1*).—This is a brief account of injury caused by *Baris* (seu *Baridius*) *chlorizans* Germ., which bores in the stem.

Mexican bean beetle situation, W. E. HINDS (*Jour. Econ. Ent., 13 (1920), No. 6, pp. 486–488*).—The author reports that scouting work, in continuation of that previously noted (E. S. R., 44, p. 554), carried on through September and October, showed *Epilachna corrupta* Muls. to occur in all, or parts, of 13 counties in Alabama. The life history appears to be quite different in the East from that in the West, where it occurs in high altitudes and under semiarid conditions.

Tamarind pod borer, Sitophilus linearis (Herbst), R. T. COTTON (*Jour. Agr. Research [U. S.], 20 (1920), No. 6, pp. 439–446, pl. 1*).—This is a report of studies of a curculionid beetle, probably a native of India, which has been

introduced into this country and is now exceedingly abundant in southern Florida where the tamarind (*Tamarindus indicus*) is now grown. It is now known to occur in the United States, India, Brazil, Mexico, Ecuador, Jamaica, Montserrat, St. Bartholomew, Cuba, and Costa Rica, and undoubtedly occurs wherever the tamarind is grown.

Its injury is confined entirely to the seed pods of the tamarind, in which the larvæ bore and reduce the seeds or beans to powder. The adult weevils enter the tough-shelled pods through the stem end. The female weevils bore through the pulpy covering and into the tough seeds. In the seeds they excavate a cylindrical cavity, and the individual egg cavities are then bored in the seed all around the interior of this larger cavity, an egg being deposited as soon as the hole is finished. From 12 to 50 eggs are laid in one group, the time taken for the completion of the group varying from one to two weeks. The eggs hatch at the end of three days, the young beginning at once to feed and bore through the seed. The four instars of the larval stage usually require from 12 to 14 days. After a prepupal stage of one day, the pupa is formed, and seven days later the adult is formed. The adult does not immediately leave the seed but remains within to harden and feed for a few days.

Fertile eggs are deposited in from 7 to 10 days after attaining adult form. "The longest oviposition period recorded lasted for 84 days, and during this time 188 eggs were deposited. Toward the latter part of this period fewer eggs were laid than at first, the female becoming more and more feeble and exhausted. Three weeks after the last egg was laid the female died. The male died a few days later. Other female weevils in captivity deposited from 126 to 165 eggs."

No parasites have been reared from any of the stages of this weevil, but *Pediculoides ventricosus* Newp. attacks and kills both the larvæ and pupæ.

Furniture beetles: Their life history and how to check or prevent the damage caused by the worm, C. J. Gahan (*Brit. Mus. (Nat. Hist.) Econ. Ser., No. 11 (1920), pp. 23, pl. 1, figs. 5*).—Following a brief general introduction, the author gives descriptions and discusses the life histories of the common furniture beetle *Anobium punctatum* DeGeer (=*striatum* Oliv.), the deathwatch beetle, *Xestobium rufovillosum* DeGeer (=*tessellatum* Oliv.), and the powder-post beetles *Lyctus brunneus* Steph. and *L. linearis* Goeze. Methods of prevention and control are also considered.

A new species of the genus Pissodes (Coleoptera), R. Hopping (*Canad. Ent., 52 (1920), Nos. 6–7, pp. 132–134, fig. 1*).—*P. terminalis*, which attacks *Pinus contorta* in the Sierra Nevada Mountains from Kern to Lassen Counties, Calif., causing serious injury to large areas of poles and saplings in lodgepole pine stands near Chester in Plumas County, is described as new. In many places the larvæ were found heavily parasitized by a small dipteran.

Dispersion of the boll weevil in 1920, B. R. Coad and R. W. Moreland (*U. S. Dept. Agr., Dept. Circ. 163 (1921), pp. 2*).—The authors consider the outstanding features of the weevil movement during 1920 to be its retardation in the eastern portion of the cotton belt, and its dispersion in Oklahoma and Texas, by which a large territory infested a number of years ago, but uninfested for the past five or six years, has been regained by the weevil. In New Mexico, where an infestation was reported in Eddy County in 1918, the weevil has apparently failed to become established. In Arizona the weevil apparently has succeeded in transferring its attack from the wild cotton of the mountains to the cultivated cotton around Tucson, weevil infestation having been found in September in three fields of cultivated cotton along the Rillito River.

Altogether 42,621 square miles of new territory were invaded by the weevil during 1920 and only 752 square miles in Tennessee were lost, so that the net gain was 41,869 square miles. Only about 73,000 square miles of cotton-producing territory now remain uninfested. Tables are given which show the total area, in square miles, by States, infested by the boll weevil in 1920, and the proportion of cotton crop produced by States in area now free from the boll weevil. Considering the cotton-producing States as a whole, it appears that a general average of 16.2 per cent of the total cotton crop is produced in uninfested territory.

Some rules for poisoning the cotton boll weevil, B. R. Coad and T. P. Cassidy (*U. S. Dept. Agr., Dept. Circ. 162 (1921), pp. 4*).—Much of the advice presented in a bulletin previously noted (E. S. R., 43, p. 856) has been digested and is here presented in the form of rules.

The boll weevil in Arizona, A. W. Morrill (*Calif. Cult., 56 (1921), No. 1, pp. 5, 9, figs. 2*).—This is a discussion of the boll-weevil problem as related to Arizona, where the variety which normally lives on Thurberia, or wild cotton, in certain mountain ranges in southern Arizona has been discovered in cotton fields near Tucson. This is shown to differ biologically in several important respects from the eastern form. While the eastern form has been known to live without food or water for 192 days, the western variety has a correspondingly longevity record of 625 days. The western variety apparently is especially adapted for hibernation in the bolls of the food plant, and in connection with its adaptation to arid regions, has shown a preference for bolls of the food plants for egg deposition, thus avoiding much of the climatic control which takes place in the case of the eastern form.

It is pointed out that the Thurberia, or wild cotton, bollworm has been regarded as of as much importance as a potential enemy of cotton as is the boll weevil.

In discussing the problem of eradicating the boll weevil on wild cotton, it is pointed out that the insect pests must first be eliminated, since, if the wild cotton plants are reduced in number unwisely, an overcrowding and forced migration of the pests may result.

The Arizona boll weevil, C. T. Vorhies (*Calif. Cult., 56 (1921), No. 5, p. 131*).—This is in continuation of the discussion by Morrill noted above.

Arizona Thurberia weevil, D. B. Mackie (*Calif. Cult., 56 (1921), No. 11, p. 345*).—This is an account of the boll-weevil situation in Arizona based upon an investigation made in Arizona by the chief quarantine officer of the California Department of Agriculture in January, 1921. The report supplements the accounts by Morrill and Vorhies noted above.

Rice weevil (Calandra), Sitophilus oryza L., R. T. Cotton (*Jour. Agr. Research [U. S.], 20 (1920), No. 6, pp. 409–422, pl. 1*).—This is a report of biological studies of the rice weevil, which were conducted by the Bureau of Entomology, U. S. Department of Agriculture, at Orlando, Fla., during 1919 and the early part of 1920. Much of the data is presented in tabular form.

The largest number of eggs laid by a single weevil was 576, laid during a period of 149 days. The eggs usually hatch in from 3 to 5 days during the warm months of the year, although by far the majority of them hatch in 4 days. The first three larval stages average 4 days each, while the fourth stage varies from 4 to 9 days. The pupal stage normally lasts for 5 days.

"The period from egg to adult during the warm months of the year averages 28 days, which together with a preoviposition period of 7 days gives a life cycle of approximately 35 days. In some cases the life cycle is completed in a much shorter period, one reared individual completing the cycle in 30 days. On

the other hand, the life cycle may be very considerably prolonged on account of unfavorable food and weather conditions. . . . In Florida there are usually about seven full generations a year, six during the period from April to November and one from December to March."

The predacious mite *Pediculoides ventricosus* Newp. is often found in weevil-infested corn in the Southern States and attacks and kills eggs, larvæ, and pupæ. Two hymenopterous parasites, *Cercocephala elegans* Westw. and *Aplastomorpha vandinei* Tucker, are found in great abundance in Florida attacking the larvæ. The most effective control measures consist in the use of carbon bisulphid or of heat. Where carbon bisulphid is used infested grain should be fumigated in a gas-tight container or crib at the rate of 4 to 6 lbs. to 1,000 cu. ft. A temperature of 116° F. maintained for two hours will kill all adults, and a temperature of 124° maintained for two hours will kill all the stages.

A biological study of this species in Alabama, by Hinds and Turner, reported in 1911, has been noted (E. S. R., 25, p. 762).

The bean stem weevil, a minor pest of beans, R. W. JACK (*Rhodesia Agr. Jour., 17 (1920), No. 5, pp. 452–455, pls. 2*).—This is an account of *Alcides leucogrammus* Erich., which is an enemy of French beans in gardens and also of the cowpea or kafir bean. It was first identified as a pest in 1913, and has since appeared annually on the experimental plats at the agricultural laboratories at Salisbury and has been observed on farms in different parts of Mashonaland. Injury is caused by the adults feeding mainly upon the stems and branches of the plants, in which they cut longitudinal grooves. The larvæ feed on the tissues at the base of the stem, several commonly being found in one plant, which causes considerable swelling.

Opius fletcheri as a parasite of the melon fly in Hawaii, H. F. WILLARD (*Jour. Agr. Research [U. S.], 20 (1920), No. 6, pp. 423–438, figs. 13*).—This is a report from the Bureau of Entomology, U. S. Department of Agriculture, of studies of the biology of *O. fletcheri* Silv., and of its activities since the parasite was introduced into the Hawaiian Islands from India in May, 1916. During the period since its introduction it has become firmly established on all the large islands of the group, and while this parasite alone will never exercise a complete control over the melon fly in Hawaii, it has already proved of much value by decreasing the numbers considerably. The highest percentage of parasitism is said to have existed in September, 1918, when 1,070 out of 3,594 melon-fly larvæ under observation, or 29.8 per cent, were parasitized by it. The parasitism from all cucumbers collected during 1918 was 18.1 per cent.

Symbiosis of Blastophaga and the fig family, G. P. RIXFORD (*Jour. Econ. Ent., 13 (1920), No. 6, pp. 459–463*).

FOODS—HUMAN NUTRITION.

Food industries, H. T. VULTÉ and S. B. VANDERBILT (*Easton, Pa.: Chem. Pub. Co., 1920, 3. ed., pp. X+325, figs. 82*).—The principal change in the third edition of this elementary textbook on the production and manufacture of staple foods consists in the substitution of a chapter on nonalcoholic beverages for the two chapters on alcoholic beverages in the previous edition (E. S. R., 32, p. 658).

Recent advances in our knowledge of food selection and preparation, M. T. WELLMAN (*Jour. Home Econ., 12 (1920), No. 1, pp. 15–25*).—This paper summarizes a considerable amount of work on foods published during the latter part of 1919.

What is experimental cookery? M. C. DENTON (*Jour. Home Econ., 11 (1919), No. 3, pp. 119–123*).—The underlying principles of experimental cookery

are discussed, and the importance of using exact scientific methods is insisted upon.

Utilization of kid, rabbit, horse, and seal meats as food, A. D. HOLMES and H. J. DEUEL, JR. (*Jour. Indus. and Engin. Chem., 12 (1920), No. 10, pp. 975–977*).—This contribution from the Office of Home Economics, U. S. Department of Agriculture, reports the results of an investigation of the digestibility of kid, rabbit, horse, and seal meats when served as the chief source of protein in a diet which contained also bread, butter, fruit (oranges), and sugar. The data are summarized in the following table:

Summary of digestion experiments with meats.

Kind of meat.	Number of experiments.	Digestibility of entire ration.				Amount of meat eaten.		Digestibility of meat protein alone.
		Protein.	Fat.	Carbohydrate.	Ash.	Average per man per day.	Maximum per man per day.	
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Grams.*	*Grams.*	*Per cent.*
Kid	3	91.7	95.5	98.6	87.9	163	166	94.1
Rabbit	5	90.0	95.8	97.9	80.1	205	217	91.8
Horse	7	91.3	94.5	98.5	83.2	306	414	96.4
Seal	6	91.9	[1] 92.9	[1] 98.0	[1] 88.2	230	281	94.6

[1] Average of four experiments.

"The total ration in all the tests was very well utilized—the carbohydrates, especially, being very completely absorbed, from which it is apparent that these meats did not decrease the digestibility of the other constituents of the diet. In every case the average amount of meat eaten daily was in excess of that included in the ordinary diet of the average person, and in no instance were any physiological disturbances noted. The digestibility of the protein of the four kinds of meat studied was essentially the same as that of other and better-known meats."

The use of desiccated eggs, L. LHAMON (*Jour. Home Econ., 11 (1919), No. 3, pp. 108–115*).—A study was made of the nutritive value, cost, and general use of commercial desiccated eggs. The conclusions reached were that they are not unhealthful; that in most cases they gave satisfactory results when substituted for fresh eggs in cookery; and that the cost is relatively low.

Changes taking place in the tempering of wheat, E. L. TAGUE (*Jour. Agr. Research [U. S.], 20 (1920), No. 4, pp. 271–275*).—With a view to standardizing time, temperature, and moisture conditions for the tempering of wheat before grinding to flour, tests were conducted at the Kansas Experiment Station on three lots of wheat, a variety of hard wheat, known as Kanred, developed at the station, a hard red wheat from central Kansas, and a soft wheat from Colorado, known as Arizona White. The conditions tested were a time of 24, 48, and 72 hours, temperatures of 5, 20, and 40° C., and a moisture content of 15.5 and 18 per cent. The original moisture content of the wheat, as determined by drying in the air oven at 110° to constant weight, was found to be 12.65 per cent for Kanred, 10.86 for hard red winter wheat, and 10.8 for the Arizona White.

A 200 gm. sample of the wheat was weighed out into a 500 cc. bottle and brought up to the desired moisture content by the addition of distilled water. The bottle was then corked, shaken, and placed in a large water thermostat which had been brought to the desired temperature. After remaining the specified time the bottle was removed and the wheat ground as rapidly as

possible in a flour mill, each sample being put through the mill the same number of times. The milling qualities of the wheat were noted and the yields or straight flour were calculated, after which the flour was analyzed for H-ion concentration, total acidity, water soluble phosphorus, and titrable nitrogen by the methods previously described by Swanson and Tague (E. S. R., 40, p. 507). For each variety of wheat an untempered sample was ground and analyzed in the same way.

The milling qualities of all the wheats were improved by tempering to a moisture content of 15.5 per cent. A moisture content of 18 per cent proved too high, the resulting flour being sticky and tending to clog the sieves. The milling qualities of the drier and hard wheats were improved by tempering more than the wetter and soft wheat. At 5° practically no chemical changes of the wheat occurred, while at 20° an increase in H-ion concentration, total acidity, water soluble phosphorus, and titrable nitrogen occurred. These changes were even more pronounced at 40°. The time of tempering appeared to be a factor in chemical changes, but not in physical. Both yield and milling quality were the best at a temperature of 20 to 25°, the physical changes at 40° proving detrimental to the milling qualities.

Bread making in pans of different materials, F. A. OSBORN (*Jour. Home Econ., 11 (1919), No 8, p. 352*).—This paper records the results of baking tests, under regulated conditions, with bread pans of different materials, including graniteware, Russia iron, tin, pyrex, unpolished aluminum, and polished aluminum. The greatest burning was found in the granite pans, with the others following in the order given. The bread in the polished aluminum pan was a light brown, and not burned at all.

Cake making (*Jour. Home Econ., 11 (1919), No. 8, pp. 352–354*).—An experiment made by the home economics department of Milwaukee-Downer College to determine the best temperature for baking "butter" cake is reported. The results seemed to indicate that low oven temperatures (121 to 177° C.) were preferable.

Changes in physical and chemical constants of fats used for frying a standard dough, A. F. MORGAN and E. R. COZENS (*Jour. Home Econ., 11 (1919), No. 9, pp. 394–402*).—This paper gives a report of a series of experiments on fats used for frying. A standard doughnut dough was fried in various fats, including lard, olive oil, crisco, and cottolene, and the absorption of the different fats by the doughnuts and various changes in the fats due to frying are reported in tables. The authors conclude that the changes observed point to partial hydrolysis and oxidation. The fats with the least acidity were absorbed to the greatest extent.

Changes in fats absorbed by fried foods, S. WOODRUFF and K. BLUNT (*Jour. Home Econ., 11 (1919), No. 10, pp. 440–452*).—The experiments described deal with the absorption of fat (lard and Wesson oil) by potatoes and doughnuts during frying, and the changes which occur in the fats.

The amounts of lard and of Wesson oil absorbed were about the same. In the case of the potato chips the temperature of frying did not affect the amount of fat absorbed, but both the temperature and length of time of frying affected the amount of fat absorbed by the doughnuts. Lard decomposed more than Wesson oil, and the absorbed fat changed more than that which was left after frying.

Absorption of fat by fried batters and doughs, and causes of variation, M. C. DENTON, E. WENGEL, and L. PRITCHETT (*Jour. Home Econ., 12 (1920), No. 3, pp. 111–127*).—The experiments reported show the effect of many factors upon the amount of fat absorbed by batter and dough mixtures in frying.

The results seem to indicate that higher fat absorption usually accompanies a comparatively large increase in volume. At 200° C. mixtures without egg absorbed less fat than at 150°, but mixtures containing egg absorbed more at 200° than at 150°. Softer doughs absorbed more than stiff doughs. Gluten seemed to decrease the absorption, while the influence of fat, egg, sugar, and milk in the mixture was to increase absorption.

The nation's fruit and vegetables: Problems of preservation, S. L. BENSUSAN (*Jour. Min. Agr.* [*London*], *27* (*1920*), *No. 6*, *pp. 554–558*, *pl. 1*).—An account is given of the development in Great Britain of work in domestic canning and preserving of foods under the auspices of the Ministry of Agriculture and Fisheries, including the establishment of an experimental station for the study of fruit preservation problems at Campden, Gloucestershire.

Effect of pack and depth of water bath upon interior temperature of jars in cold pack canning, C. E. CASTLE (*Jour. Home Econ.*, *11* (*1919*), *No. 6*, *pp. 246–251*).—The results are reported of a study of interior temperatures, under varied conditions, of vegetables processed for one hour from the time the bath started to boil. These were found to vary considerably with the mass of solid material in the jar, the depth of the bath, and the initial temperature of the bath. The interior temperature of tightly packed cans was not high enough to assure sterilization of the vegetable when the ordinary home methods were used.

The canning of asparagus, A. E. SKINNER and G. GLASGOW (*Jour. Home Econ.*, *11* (*1919*), *No. 4*, *pp. 154–157*).—In the experiments reported, the asparagus was canned by the cold-pack method in a water bath. Good results were obtained by putting a small amount of vinegar or acetic acid in the water used for filling the jars. When acid was used the time of processing could be reduced. When water alone, or a brine, was used, a longer period was required to prevent spoiling, and the asparagus was softened to an undesirable extent before it was sterilized.

A bacteriological study of canned ripe olives, S. A. KOSER (*Jour. Agr. Research* [*U. S.*], *20* (*1920*), *No. 5*, *pp. 375–379*).—This is a report of the results of the bacteriological examination at the Bureau of Chemistry, U. S. Department of Agriculture, of some of the lots of canned ripe olives collected during the investigation of the outbreaks of botulism traceable to ripe olives.

In testing for aerobes dextrose agar slants were used and for anaerobes a 0.2 per cent dextrose beef infusion broth (pH=7.4 to 7.6) covered with a layer of liquid petrolatum, or in a few cases a 2 per cent dextrose beef infusion broth containing a small piece of meat and similarly covered with oil. The agar slants were inoculated with 0.5 cc. of the liquid to be tested, and the broth with 1 to 1.5 cc. of the liquid and a small piece of the olive itself. Incubation was at 37° C.

The total number of commercial containers examined was 480, including 338 cans and 142 glass containers. Of the former, out of 181 apparently normal cans 8, and out of 157 "swelled" or "springy" cans 154 were found to contain living microorganisms. Of 116 glass containers, normal in appearance and odor, 11, and of 26 obviously spoiled, all gave positive results. Of the total number of containers giving positive cultural results, 117 were further tested to determine the general types of organisms. In addition to *Bacillus botulinus*, the finding of which in 7 of the spoiled glass jars has been previously reported by De Bord et al. (E. S. R., 43, p. 168), the general results were as follows:

The flora of the swelled cans consisted largely of members of the colon group, either in pure culture or in mixed culture with several other types.

Four of the 8 normal cans yielded cultures of the colon group, and the others cocci and several types of aerobic spore-forming bacilli. All of the types found in the normal glass jars were of the latter description. The organisms encountered in the spoiled samples showed a great diversity of types among which the colon group predominated. The large numbers and diversity of types encountered are thought to indicate insufficient heating of the product.

Methods to be used in the study of gas consumption of the ordinary household range [when used for cooking] (*Jour. Home Econ., 11 (1919), No. 4, pp. 158–162*).—Apparatus and experimental methods are described and a form is suggested for the record of data. The work was carried on in the experimental kitchen of the Office of Home Economics, U. S. Department of Agriculture.

Racial and other differences in dietary customs, V. PHILLIPS and L. HOWELL (*Jour. Home Econ., 12 (1920), No. 9, pp. 396–411*).—An analysis is made of a dietary survey among 105 low salaried foreign families of New York City. Most of the families were Italian, Jewish, or Negro.

Most of the families spent too large a proportion of their income on meat and eggs. Sixty-one per cent of the families were getting less than 3,000 calories per man per day, and 57 per cent showed less than the required amount of calcium. The Negro families spent the most money for food, but only 19 per of them were getting as much as 3,000 calories per man per day.

Jewish dietary problems, M. L. SCHAPIRO (*Jour. Home Econ., 11 (1919), No. 2, pp. 47–59*).—An outline is given of the Jewish laws pertaining to diet, with a discussion of the resulting dietary habits, as related to home economics work in the New York City public schools. Suggestions are made for modifying these habits without violating the requirements of the Jewish religion in order to make the meals more healthful.

Is the Chinese diet adequate? CHI CHE WANG (*Jour. Home Econ., 12 (1920), No. 7, pp. 289–293*).—The author discusses the Chinese diet from the point of view of nutrition. Rice is said to be used only as we use potatoes and cereals, vegetables and meat and eggs are consumed generously. The diet as described appears to be entirely adequate to meet the requirements of the body.

A minimum food allowance and a basic food order, L. H. GILLETT (*Jour. Home Econ., 12 (1920), No. 7, pp. 319–324*).—The food requirements of a family of five are expressed in terms of milk, meat, vegetables, fruits, fats, cereals, and sugar. The minimum cost of a well-balanced diet at the market prices of April 1, 1920, is calculated to be 1.47 cts. per hundred calories.

Gastric response to foods, VIII, IX (*Science, n. ser., 51 (1920), No. 1316, p. 299; 52 (1920), No. 1341, pp. 253, 254, fig. 1*).—The following papers are in continuation of the series of studies previously noted (E. S. R., 42, p. 861).

VIII. *Is unpalatable food properly digested?* R. C. Holder, C. A. Smith, and P. B. Hawk.—To determine whether unpalatable food is utilized by the body to the same extent as the same food palatably served, a 7-day period during which the subjects were on a uniform diet served palatably and amid pleasant surroundings was followed by a 2-day period in which the same food was served in a most unappetizing way. Although the food was so unpalatable that one of the two subjects was unable to retain it, differences in utilization of it and the palatable food, as determined by the nitrogen balance of the other subject, were very slight. This indicates that palatability does not aid to any extent in the digestion, absorption, and utilization of food.

IX. *The influence of worry on gastric digestion,* R. J. Miller, O. Bergeim, and P. B. Hawk.—An illustration is given of the profound effect of mental anxiety

on gastric digestion. Worry over an examination resulted in prolonging for over 2 hours evacuation from the stomach of a test meal of fried chicken. The intragastric acidity was abnormally high, as shown by comparison with the results obtained in a similar test on the same subject obtained a week later under the best mental conditions. The experiment is considered to be a good demonstration of a purely emotional dyspepsia.

Gastric response to foods, X–XIII (*Amer. Jour. Physiol., 52 (1920), Nos. 1, pp. 1–53, figs. 74; 2, pp. 248–275, figs. 28; 53 (1920), No. 1, pp. 65–88, figs. 32*).—The following papers are in continuation of the series of studies noted above:

X. *The psychic secretion of gastric juice in normal men*, R. J. Miller, O. Bergeim, M. E. Rehfuss, and P. B. Hawk.—This paper consists of the results of a study of the relative importance of different psychic factors upon the appetite stimulation of gastric juice, and upon the evacuation time and ultimate utilization of the food. Sight of appetizing food and the sound of cooking food gave rise to distinct secretion of gastric juice. Odor produced less stimulation, and taste and chewing no marked stimulation.

The appearance and palatability of the food affected the stimulation of the gastric juice and the evacuation time in susceptible but not in phlegmatic subjects. The ultimate utilization of the protein of the diet was not, however, appreciably affected by the appearance or palatability of the food. Anxiety and mental strain delayed gastric digestion as noted above.

XI. *The influence of tea, coffee, and cocoa upon digestion*, R. J. Miller, O. Bergeim, M. E. Rehfuss, and P. B. Hawk.—The object of the experiments reported in this paper was to determine the effect upon the gastric response to mixed meals of the addition to such meals of equal volumes of water, tea, coffee, or cocoa, hot or cold, and with or without the addition of cream and sugar. Thirty-seven experiments were carried out on four different subjects, duplicates being made on each subject with the basal diet alone.

Evacuation of the stomach was not appreciably delayed by the drinking of 1 liter of any of the above-mentioned beverages, with the exception of cocoa and of coffee to which sugar had been added. The temperature of the beverage did not appear to affect its evacuation time. The development of gastric acidity was distinctly delayed by cocoa, to a somewhat less extent by coffee with sugar, and only slightly by the other beverages.

Tea and coffee in 1 liter quantities gave rise to marked acceleration of the heart beat and to vasomotor relaxation, tremors, and other nervous symptoms. Cocoa did not produce these effects, but brought about a feeling of fullness.

The secretion of urine in the first 90 minutes after ingestion of tea and coffee varied from 550 to 866 cc. and after cocoa from 125 to 372 cc.

XII. *The response of the human stomach to pies, cakes, and puddings*, R. J. Miller, H. L. Fowler, O. Bergeim, M. E. Rehfuss, and P. B. Hawk.—A study is reported of the acid responses and evacuation times of various pies, cakes, and puddings in the normal human stomach. The average evacuation time for all subjects was 2 hours and 18 minutes for puddings, 2 hours and 27 minutes for pies, and 3 hours and 2 minutes for cakes. The corresponding total acidity values were 92, 90, and 90, respectively. Direct comparisons of the three types of foods on the same individuals showed that puddings were handled more readily than cakes and pies, and pies more readily than cakes.

XIII. *The influence of sugars and candies on gastric secretion*, R. J. Miller, O. Bergeim, M. E. Rehfuss, and P. B. Hawk.—Continuing the investigation noted above, the effect has been determined of certain sugars, candies, and confections on the secretory and motor responses of the stomach of normal adults.

Large amounts (100 gm.) of cane sugar or glucose in concentrated solution depressed gastric secretion to a marked extent and delayed evacuation of the stomach, while small amounts (10 gm.) did not appreciably inhibit either gastric secretion or evacuation. In general, candies were found to depress secretion and delay evacuation in proportion to their sugar content and the amount ingested. Added food ingredients such as milk, eggs, or chocolate tended to stimulate secretion, while certain flavoring agents such as peppermint oil delayed evacuation.

The authors conclude that candy should be eaten after, rather than before, meals, and that hard candies are preferable to cream candies for children, because of the smaller quantity of less concentrated sugar solution derived from them.

H-ion concentration of the contents of the small intestine, J. F. McClendon, F. S. Bissell, E. R. Lowe, and P. F. Meyer (*Jour. Amer. Med. Assoc., 75 (1920), No. 24, pp. 1638–1641*).—Following an historical review of the literature on the reaction of the intestinal contents, the authors report briefly the results of determinations of the H-ion concentration of the small intestines of two healthy subjects at intervals during a 3-day period on a mixed diet. The H-ion concentration as determined by the hydrogen electrode varied from pH=4.1 to pH=6.5.

Children's teeth, a community responsibility, T. Clark and H. B. Butler (*Pub. Health Rpts. [U. S.], 35 (1920), No. 47, pp. 2763–2779, pl. 1*).—Reference is made to food and other conditions which affect nature and health of teeth.

Nutrition classes for children, M. A. Harper (*Jour. Home Econ., 11 (1919), No. 11, pp. 471–480*).—Work done among the undernourished children by the New York Association for Improving the Condition of the Poor is described. The "case work" in the homes, as well as the clinical work, was conducted by dietitians.

A malnutrition clinic as a university problem in applied dietaries, L. Roberts (*Jour. Home Econ., 11 (1919), No. 3, pp. 95–101, figs. 4*).—A report of the work of a home economics class at the University of Chicago in connection with a dispensary of Rush Medical College. The students were individually assigned to cases of undernourished children. The favorable results of a few weeks' work are indicated by weight charts of some of the children.

Nutrition on diets practically devoid of fat, J. C. Drummond (*Jour. Physiol., 54 (1920), No. 4, pp. XXX, XXXI*).—This is a brief description of an attempt to solve the question as to whether or not fat is indispensable in the diet by means of feeding experiments with young rats. The basal ration included casein and starch (rendered as fat-free as possible by extraction with alcohol and ether), inorganic salts, orange juice, yeast extract, and as a source of fat-soluble A a daily ration of 5 cc. of concentrated carrot extract, prepared by the method described by Zilva (E. S. R., 44, p. 261) and which contained only the smallest traces of neutral fat. The approximate daily intake of neutral fat of the entire ration was estimated at 0.014 gm. in an average total intake of 15 gm.

All of the animals except one remained in good health for nearly six months on this diet and showed considerable although subnormal growth. On postmortem examination considerable deposits of body fat were found. The author concludes that unless minute amounts of fat play as important a rôle in metabolism as do the minute quantities of vitamins, it is reasonable to suggest that pure fats are dispensable constituents of the diet. "This does not, however, diminish the value of fats in the food, for one is led to think that the subnormal growth observed in these experiments is largely due to the diffi-

culty of balancing the protein level and calorific intake on a diet containing no neutral fats."

The influence of dry v. fresh green plant tissue on calcium metabolism, E. F. Robb (*Science, n. ser., 52 (1920), No. 1352, p. 510*).—In reply to a note by Hart et al. (E. S. R., 44, p. 64), the author suggests the possibility that the loss of calcium reported by these authors may have been due to a lack of antiscorbutic rather than an antirachitic vitamin. In support of this, experiments are cited in which guinea pigs which had been on a diet of dried plants 14 days before the experiment eliminated twice as much calcium as those which had been fed on a diet of fresh green plants supplemented with calcium-free orange juice. Scurvy appeared in all the animals on the dry diet but in none of those on the fresh diet.

Observations on vitamin content of foods, M. Davis et al. (*Jour. Home Econ., 12 (1920), No. 5, pp. 209–216*).—Some of the significant facts brought out by these feeding experiments were that autoclaving for two and one-half hours at 15 lbs. pressure seemed to destroy the antineuritic properties of an ordinary pigeon ration. Powdered milk was successfully used as the only source of antiscorbutic for guinea pigs, and potato in sufficiently large amounts served effectively as an antiscorbutic.

The pathogenesis of deficiency disease.—X, The effects of some food deficiencies and excesses on the thyroid gland, R. McCarrison (*Indian Jour. Med. Research, 7 (1920), No. 3, pp. 633–647, pls. 5, figs. 2*).—In this paper, which is a continuation of the investigation previously noted (E. S. R., 43, p. 664), the author summarizes his previous observations with respect to the influence of imperfect and ill-balanced foods on the thyroid glands of pigeons and monkeys.

In general the dietaries leading to a reduction in size and weight of the thyroid glands were those deficient in vitamins, while those containing adequate provision of vitamins but excessively rich in proteins and fats caused marked degrees of hyperplasia of the glands. It is noted that while a scorbutic diet of crushed oats and autoclaved milk may cause in guinea pigs considerable enlargement of the thyroid gland, this enlargement is in general the result of congestion and hemorrhagic infiltration of the tissues. A further effect of dietaries deficient in vitamins is to render the thyroid gland susceptible to the harmful action of intestinal bacteria with resulting atrophic and necrotic changes.

"The addition of onions to a dietary excessively rich in protein and fats, while containing at the same time an abundance of vitamins, markedly retards the development of thyroid hyperplasia and the tendency to acinar 'budding' in pigeons living in confinement. The beneficial influence of the onions is held to be due in part at least to their action in restraining the growth of putrefactive types of bacteria in the gastro-intestinal tract and in retarding the absorption of their products. It is suggested that onion juice might prove of benefit in restraining the thyroid hyperplasia of Graves's disease.

"The changes in the parathyroids induced by a diet deficient in vitamins and excessively rich in starch and fat appear to be related in their origin to intestinal anaerobes, the noxious action of which is greatly favored by the defective diet."

A diabetic dietary, E. E. Cornwall (*Jour. Amer. Med. Assoc., 75 (1920), No. 24, pp. 1642, 1643*).—In the diabetic dietary illustrated, selected articles of food are arranged in groups according to the carbohydrate content of 1 oz. portions. The groups are 10 in number, with carbohydrate content varying from 0 to 20 gm. to the ounce. The first three groups form the regular field of choice for severely restricted diets, the first containing articles eaten for their protein or fat or for variety and stimulation, none of which contain any carbohydrate. The second group contains vegetables furnishing 1 gm. of carbohydrate to the

ounce, and the third group articles which are important sources of protein and fat containing 1 gm. of carbohydrate to the ounce. This group includes cottage cheese, cream, oysters, butternuts, and olives.

ANIMAL PRODUCTION.

The determination of Mendelian ratios in species with small numbers of offspring, I, G. JUST (*Arch. Mikros. Anat., 94 (1920), pp. 604–652, figs. 4*).—Using published data on inheritance in Drosophila, the author presents an empirical proof of a method suggested by W. Weinberg[1] for estimating true Mendelian ratios in populations where owing to the small number of offspring from the average mating the number of recessives in families where they do occur appears abnormally large.

The inheritance of acquired characters, E. W. MACBRIDE (*Sci. Prog. [London], 15 (1921), No. 59, pp. 392–405*).—This article is largely a review of Kammerer's experiments with salamanders and the midwife toad. In the author's opinion Kammerer has practically proved the case for the inheritance of acquired characters. The mutilation experiments of Weismann and his followers are called childish, and the mutants employed by Mendelists in their experiments are dismissed as pathological.

Hybridization studies.—VIII, Peafowl hybrids, H. POLL (*Arch. Mikros. Anat., 94 (1920), pp. 365–458, pls. 5, figs. 6*).—Continuing his studies of hybrids (E. S. R., 28, p. 877), the author describes two hybrids (both sterile males) between peacocks and guinea hens and reports histological observations on the testes of the hybrids and the testes of a peacock and several guinea cocks. The upper tail coverts of the hybrids, while strongly developed, were not nearly as long as those (the so-called tail) in the male peafowl and showed cross-barring without trace of "eyes." Spermatogenesis in the hybrids did not proceed beyond synapsis.

Note on the "pelvic wing" in poultry, W. A. LIPPINCOTT (*Amer. Nat., 54 (1920), No. 635, pp. 535–539, figs. 7*).—In young partially feathered chickens and turkeys examined at the Kansas Experiment Station the author found a precocious development of quill-like feathers on the postero-ventral border of the femoral feather-tract of the hind limb. These feathers are considered homologous to those of the humeral tract of the wing. Similar "pelvic wings" have been described for doves and other birds by C. W. Beebe,[2] who regards them as having evolutionary significance.

What becomes of the spermatozoa ejaculated into the uterus and not used for fertilization? J. SOBOTTA (*Arch. Mikros. Anat., 94 (1920), pp. 185–207, pl. 1*).—Observations are reported on mice indicating that the excess semen is absorbed through the mucous membrane of the uterus by leucocyte action.

The structure of certain chromosomes and the mechanism of their division, A. B. LEE (*Quart. Jour. Micros. Sci. [London], n. ser., 65 (1920), No. 257, pp. 1–32, pls. 2*).—The author reports observations on chromosomes in various tissues of Amphibia and reviews the controversy over the structure of chromosomes. It is concluded that the plant chromosome has an alveolated (i. e., a more or less hollow) axis during cell division, while the animal chromosome has a solid basophile axis possessing a spiral sculpturing on its surface (the periaxial spiral). The solid and perhaps also the alveolated axis is inclosed in a sheath stainable by acid dyes. The so-called chromomeres are considered faultily interpreted images of bulges and twists in the axis. It is also contended that chromosomes—at least the long chromosomes of Amphibia and

[1] Arch. Rassen u. Gesell. Biol., 9 (1912), No. 2, pp. 165–174.
[2] Zoologica [N. Y.], 2 (1915), No. 2, pp. 39–52.

Orthoptera—do not split longitudinally at cell division. The two limbs of the V-shaped chromosome are thought to come close together and then break apart at the bend.

The hypertrophy of the adrenal capsules in the pregnant rabbit is not to be attributed to the presence of the fetus, J. WATRIN (*Compt. Rend. Soc. Biol. [Paris], 82 (1919), No. 34, pp. 1405–1407*).—The author has succeeded in removing 10-day rabbit embryos by incisions in the uterus. The placentæ continued to develop, and the hypertrophy of the adrenal capsules characteristic of pregnancy also occurred. The hypertrophy is attributed to the fetal part of the placenta, since artificial maternal placentæ induced by mutilation of the uterus of nonpregnant rabbits whose ovaries showed a corpus luteum did not result in a similar capsular hypertrophy.

On the influence of complete thyroidectomy during pregnancy upon the development of the fetus and on the duration of gestations, T. UKITA (*Acta Scholæ Med. Univ. Imp. Kioto, 3 (1919), No. 2, pp. 287–297, pls. 2*).—The gestation periods of four pregnant rabbits from which the thyroids were removed during the first 10 days of pregnancy varied from 51 (abortion) to 73 days, the normal gestation period being 30 days. Three rabbits operated on at later stages of pregnancy showed gestation periods varying from 30 to 40 days. The thyroid glands of all the young were enlarged, in compensation, it is believed, to the maternal thyroidectomy. The young were also small and weak at birth and incompletely ossified. A study of the bone centers in the limbs by means of radiographs showed that retardation in bone formation continued for several days after birth.

The influence of thyroid feeding upon the physiological action of the pancreas, H. HOSHIMOTO (*Endocrinology, 4 (1920), No. 1, pp. 56–62*).—Experiments involving 14 white rats are reported.

Adding dry thyroid to a bread and milk diet resulted in a marked decrease in the diastase content (Wohlgemuth's method) of the pancreas, the maximum decrease being 92 per cent. The pancreas itself was often increased in size, and the number of acidophile granules in the pancreas cells was reduced. The decrease in pancreatic diastase is not attributed to general metabolic disturbances since it frequently antedated any evidence of such.

The influence of the thyroids on the functions of the suprarenals, P. T. HERRING (*Endocrinology, 4 (1920), No. 4, pp. 577–599*).—This is a survey of the literature dealing with the influence of the thyroids upon the adrenal glands and includes a bibliography of 69 titles, mostly of very recent work.

There is much evidence that hyperthyroidism increases the size and weight of the adrenals, but it is pointed out that these observations were made chiefly on the albino rat and that similar changes may not occur in other animals. Hypothyroidism seems to be without effect on the adrenalin load of the adrenals. The author apparently inclines to the view that cases of specific influence of one endocrine gland upon another are relatively rare, and that the primary effect of disturbance in endocrine function is a change in metabolism probably acting through the liver, any apparent effect on another gland being a secondary result.

The effect of thyroid feeding and of thyro-parathyroidectomy upon the pituitrin content of the posterior lobe of the pituitary, the cerebro-spinal fluid, and blood, P. T. HERRING (*Roy. Soc. [London] Proc., Ser. B, 92 (1921), No. B 643, pp. 102–107, figs. 5*).—In experiments with rats it was found that neither the feeding of ox thyroid nor the ablation of the thyroids and the parathyroids influences the pituitrin content of the pituitary body (posterior lobe) or causes the appearance of pituitrin in the blood and cerebro-spinal fluid.

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The pituitrin content of these tissues was estimated mainly from their effect in causing the contraction of the rat's uterus.

The effect of administration of small amounts of thyroid gland on the size and weight of certain organs in the male white rat, J. A. Hewitt (*Quart. Jour. Expt. Physiol., 12 (1920), No. 4, pp. 347–354*).—Two series of experiments are reported in which rats were fed 0.1 gm. or more of fresh thyroid per day. To determine the changes produced by the feeding, the weights of the organs of the experimental animals were compared with the weights of the corresponding organs of normal rats of the same body length given in Donaldson's tables (E. S. R., 40, p. 546). It is concluded that the thyroid feeding caused hypertrophy of the heart, liver, spleen, kidneys, adrenals, and possibly the pituitary, while the thyroid itself was reduced in size.

The relationship between thyroid and parathyroids, S. Vincent and J. S. Arnason (*Endocrinology, 4 (1920), No. 2, pp. 199–204*).—The authors review the literature on the relationship between the thyroids and the parathyroids, and report experiments with 20 rabbits which do not lend support to the view that the parathyroids left behind after thyroidectomy become converted into thyroid tissue.

An economic investigation of the Montane Tussock-grassland of New Zealand, I–IX, L. Cockayne (*New Zeal. Jour. Agr., 18 (1919), Nos. 1, pp. 1–9; 6, pp. 321–331, figs. 3; 19 (1919), Nos. 3, pp. 129–138, figs. 10; 6, pp. 343–346, figs. 2; 20 (1920), Nos. 2, pp. 82–94, figs. 11; 4, pp. 209–217, figs. 8; 6, pp. 337–345, figs. 7; 21 (1920), Nos. 4, pp. 176–188, figs. 8; 6, pp. 324–334, figs. 4*).—These are the first installments of a still uncompleted series of studies of the flora of New Zealand pasture lands, with particular reference to the avidity with which different species are eaten by sheep. The topics discussed in the separate numbers are sufficiently indicated by the subtitles: (1) Introduction, (2) Relative Palatability for Sheep of the Various Pasture Plants, (3) Notes on Depletion of the Grassland, (4) Increase of the California Thistle (*Cnicus arvensis*) on the Dunstan Range, Central Otago, (5) Regeneration of Grassland after Depletion, (6) Further Details Regarding the Relative Palatability for Sheep of Various Pasture Plants, (7) On the Effect of Understocking and Stocking to Its Full Capacity a Certain Area, (8) An Experiment in Central Otago Concerning the Relative Palatability for Sheep of Various Pasture Plants, and (9) Further Details Regarding the Earnscleugh (Central Otago) Palatability Experiment.

The nutritive value of cattle feeds.—I, Velvet bean feed for farm stock, J. B. Lindsey and C. L. Beals (*Massachusetts Sta. Bul. 197 (1920), pp. 61–74*).—This is a study of ground velvet bean and pod.

Analyses of the material as fed in digestion trials averaged as follows: Water 11.31, protein 16.66, ether extract 4.09, crude fiber 12.71, nitrogen-free extract 50.66, and ash 4.57 per cent. Digestion trials with 4 sheep reported very briefly showed that on the average 77 per cent of the dry matter, 74 per cent of the protein, 80 per cent of the ether extract, 62 per cent of the crude fiber, and 85 per cent of the nitrogen-free extract were digested.

Two feeding experiments with milch cows (6 and 4 animals, respectively) fed by the reversal method during 5-week periods showed that there was on the average a 5 per cent increase of milk yield when velvet bean feed replaced the bran in a grain mixture consisting of cottonseed meal, corn (or corn feed) meal, and wheat bran, 1:2:2. The roughage was hay in both cases. The percentage of fat was slightly decreased by the velvet beans in one experiment and unchanged in the other. It is estimated that 100 lbs. of dry matter in the feed produced 130 lbs. of milk in the case of the velvet bean ration, and 125 lbs. when the bran was fed.

Two experiments with swine, each involving 3 lots of 2 pigs, indicated that a ration containing 40 per cent of velvet bean feed (the other ingredients being corn feed meal and alfalfa meal) was not as satisfactory as the check ration of corn feed meal, tankage, and alfalfa meal, 8 : 1 : 1, but that rations in which half of the velvet bean feed was replaced by peanut meal gave substantially the same gain as the check ration.

Success is also reported with the use of velvet bean feed in rations for work horses. The results were reported in greater detail in Bulletin 188 (E. S. R., 41, p. 274).

Inspection of commercial feedstuffs, P. H. SMITH, E. M. BRADLEY, and J. T. HOWARD (*Massachusetts Sta. Control Ser. Bul. 13* (*1920*), *pp. 3–27*).—The proximate composition of 1,002 samples of feeding stuffs collected during the year ended August 31, 1920, are tabulated. These include cottonseed meal and feed, linseed meal, corn gluten meal and feed, hominy feed, corn meal, peanut oil feed, brewers' dried grains, distillers' dried grains, yeast or vinegar dried grains, wheat bran, middlings, shorts and red dog, wheat mixed feed, durum wheat bran, middlings and shorts, rye middlings, barley feed, oat feed, velvet bean feed, dried beet pulp, alfalfa meal, meat scrap, meat-and-bone scrap, tankage, fish meal, bone meal, and a variety of mixed and proprietary stock and poultry feeds and calf meals. The bulletin also includes tables giving the retail prices and average composition of 12 unmixed feeds in the years 1917–1920 and the monthly fluctuations in wholesale prices of 20 feeding stuffs from September, 1919, to August, 1920.

Inspection of commercial feeding stuffs, H. R. KRAYBILL and T. O. SMITH (*New Hampshire Sta. Bul. 195* (*1920*), *pp. 46*).—The proximate composition is reported of samples of alfalfa meal, dried beet pulp, brewers' dried grains, cottonseed meal, linseed meal, linseed cake, corn gluten feed, barley feed, velvet bean feed, peanut oil feed, oat hulls, wheat bran, wheat middlings, red dog, and a variety of compounded feeds, calf meals, and poultry feeds.

Laws of Nevada directly applicable to the live-stock industry (*Carson City, Nev.: State Bd. Stock Commrs., 1920, pp. 126*).—This compilation includes the laws creating the State boards of stock commissioners and sheep commissioners, laws relating to the control of infectious and contagious diseases of animals, the destruction of predatory and noxious animals, the qualifications of breeding stock, the herding, grazing, and driving of live stock and the shearing of sheep, the use and recording of marks and brands, estray and ownerless animals, the unlawful use of domesticated animals, the assessment, taxation, and licensing of live stock, liens on live stock, the shipment and sale of live stock and dressed carcasses, pollution of water supplies and the exposure of poisonous waste products, the practice of veterinary medicine, etc.

The application of the food unit method to the fattening of cattle, J. WILSON (*Roy. Dublin Soc. Sci. Proc., n. ser., 16* (*1920*), *No. 3, pp. 25–36, pls. 2*).—The feeds consumed in a number of published British steer-feeding trials, involving a total of 114 lots, are restated in terms of Scandinavian feed units (with kilograms replaced by pounds), and the relative efficiency of each ration is estimated on the basis of the gains. Rations composed mainly of roots are considered very inefficient, and the most efficient rations consisted of hay, roots, and concentrates. A wider use of the feed unit concept is advocated in reporting practical experiments, as starch values and calories are considered too technical for British farmers.

Steer-feeding experiments, J. E. NORDBY (*Idaho Sta. Circ. 15* (*1920*), *pp. 4*).—This is a report of a 100-day feeding experiment during the winter of

1919–20, involving 8 lots of twelve 2-year-old steers. The lots were separated into two main groups, one receiving long alfalfa hay and the other chopped alfalfa hay. In each group 1 lot received corn silage, 1 lot ground barley, 1 lot silage and barley, while the remaining lot was fed alfalfa alone.

In each of the 4 comparisons the chopped alfalfa lot made better gains than the comparable long alfalfa lot. The feed required per unit gain was lower, and less hay was refused by the steers. It is estimated that with a silage ration of 15 lbs., 1 lb. of silage replaced 0.575 lb. of hay, and that on a barley ration of 5 lbs., 1 lb. of barley replaced 3 lbs. of hay.

Beet molasses in fattening rations, E. J. Maynard (*Breeder's Gaz., 79 (1921), No. 5, p. 213*).—A brief summary is presented of 3 experiments at the Colorado Experiment Station from which it was concluded that 100 lbs. of molasses fed to steers saved 79.1 lbs. of barley, 77.6 lbs. of corn silage, or 33.3 lbs. of alfalfa hay. From 2.3 to 5 lbs. of molasses were fed per head per day.

Influence of rations restricted to the oat plant on reproduction in cattle, E. B. Hart, H. Steenbock, and G. C. Humphrey (*Wisconsin Sta. Research Bul. 49 (1920), pp. 22, pls. 8*).—Observations are reported on the weight and vigor of 24 calves born to 13 grade Holstein heifers that were put on experimental rations prior to breeding. Three individuals were carried through 3 gestations and 5 through 2.

Oats formed the grain ration in all cases and sodium chlorid was allowed ad libitum. When the roughage consisted of oat straw alone or oat straw fortified with casein and butter fat, the calves were born dead or weak and the placentas were retained. When a calcium salt, corn silage, or alfalfa hay was fed with the oat straw, the calves were distinctly larger and more vigorous and the placentas were usually eliminated naturally. When the roughage consisted of corn stover, clover hay, or marsh hay without oat straw, the calves were still heavier and more healthy. The marsh hay came from an alkaline marsh rich in lime and gave "splendid offspring."

Since the unsatisfactory rations were all low in calcium (less than 0.45 per cent CaO) and the satisfactory rations all contained a higher proportion of calcium, the calcium content is considered the chief factor in determining the value of a ration consisting largely of oats. Preliminary observations indicated that the nature of the ration is without substantial influence on the calcium content of the blood plasma.

On the phosphorus and calcium metabolism of the horse when fed oats exclusively, A. Scheunert (*Arch. Wiss. u. Prakt. Tierheilk., 44 (1918), Sup., pp. 188–197*).—After a 9-day preliminary period on a ration of whole oats alone (11 lbs. per day), a healthy horse was continued on the same ration through a 10-day metabolism trial during which he was exercised frequently. The average intake of P_2O_5 was 44.05 gm. per day, and of this 1.05 gm. was stored in the body. The daily CaO intake (including traces in the water) was 5.7 gm. and the outgo 14.1 gm. The amount of calcium appearing in the feces was irregular from day to day, but there was a fairly steady decrease in the urinary calcium as the experiment progressed. At the end of the test the horse showed loss of appetite, decline in strength, and a tendency to lameness.

Experimental hog feeding, H. J. Gramlich and E. L. Jenkins (*Nebraska Sta. Bul. 175 (1920), pp. 32, figs. 4*).—This is a report of 7 experiments conducted in the winter of 1917–18 and involving an unusually large number of hogs. The main object was to study the economy of varying a standard ration of shelled corn, tankage, and alfalfa hay (free choice) by replacement with or

additions of shorts, hominy feed, linseed meal, semisolid buttermilk, and corn oil cake. Results of 4 of the experiments are tabulated below:

Hog feeding experiments by the free choice self-feeder system.

Experiment.	Lot.	No. of hogs.	Length of test.	Initial weight per head.	Final weight per head.	Daily gain per head.	Feed consumed per pound of gain.					
							Shelled corn.	Shorts.	Hominy feed.	Tankage.	Semisolid buttermilk.	Alfalfa hay.
			Days.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds*	*Lbs.*	*Pounds.*	*Pounds.*
1	1	20	81	137.5	264.1	1.56	4.32	......	....	0.29	....	0.05
	2	20	81	135.9	227.7	1.13	4.62	0.69	....	....	....	.01
	3	20	81	131.3	270.1	1.68	4.06	.50	....	.21	....	.02
	4	20	81	138.6	235.6	1.20	....	....	4.50	.58	....	.14
	5	20	81	136.3	270.4	1.66	3.55	....	.80	.31	....	.02
	6	20	81	133.3	266.2	1.64	4.23	....	....	....	1.23	.14
	7	20	81	131.4	257.1	1.52	[1] 4.42	....	....	.38	....	.14
	8	20	81	132.8	250.5	1.15	4.85	....	....	.30	....	....
2	1	20	68	143.8	260.2	1.71	4.27	....	....	.17	....	.12
	2	20	68	144.6	242.5	1.44	4.69	....	....	.40	....	....
	3	20	68	141.0	211.3	1.08	5.20	....	....	....	....	.39
	4	20	68	144.8	212.1	.99	5.04	....	....	....	....	.56
4	1	16	153	51.3	222.7	1.12	[2] 4.16	....	....	.41	....	.20
	2	16	153	50.3	182.6	.86	[2] 4.34	.66	....	....	....	.19
5	......	16	153	50.9	255.1	1.33	3.51	....	....	....	1.38	....

[1] Ear corn (full feed) twice daily; reduced to shelled basis.
[2] Ear corn fed first 100 days; reduced to shelled basis.

Experiment 3 was an 84-day comparison of methods of feeding tankage in conjunction with a full feed of ear corn and alfalfa hay. When the tankage was self-fed the average daily gain was 1.58 lbs. per head, when hand fed dry (twice daily) the gain was 1.42 lbs., and when hand fed as a wet slop the gain was 1.574 lbs.

In experiment 6 one lot received corn and alfalfa hay (free choice) for 63 days and made an average daily gain of 0.85 lb. per head, while a second lot receiving corn, linseed meal, and alfalfa hay gained 1.29 lbs. and the gain was much more economical.

Experiment 7 was a 63-day study of two methods of feeding a ration of corn, corn oil cake, tankage, and alfalfa hay. The gains were substantially the same (1.31 lbs. per head per day) whether all the feeds were offered free choice or the cake and tankage were fed mixed in the proportion 3:1. In the former case the hogs consumed much more tankage in proportion to the cake.

Grains and by-products for pigs, J. W. Wilson (*South Dakota Sta. Rpt. 1920, pp. 8–10*).—A 105-day feeding experiment with 7 lots of pigs is reported. The rations (free choice) and the average daily gains per head of the pigs fed in dry lot were as follows: Corn and tankage, 1.42 lbs.; corn and fish meal, 1.47 lbs.; whole dry barley and tankage, 0.9 lb.; ground dry barley and tankage, 1.33 lbs.; and soaked whole barley and tankage, 1.23 lbs. The lots fed whole barley tended to consume excessive amounts of tankage. Two lots were kept on blue grass pasture; one received corn and tankage as supplemental feed and made an average daily gain of 1.69 lbs.; the other received ground barley and tankage and gained 1.51 lbs. per day.

Pig feeding experiments with fat-rich and carbohydrate-rich milk of varied protein content, O. Wellmann (*Landw. Jahrb., 52 (1919), No. 5, pp. 671–740*).—This is a report of digestion trials with 8 suckling pigs (Berkshires) fed either (1) skimmed or diluted milk to which diafarin, a malt extract preparation, had been added, or (2) skim milk emulsified with fat. A previous

study with diafarin milk has been noted (E. S. R., 32, p. 768). Each experiment lasted from 23 to 39 days. The following table summarizes the main results:

Digestibility of "corrected" skim milk of varied protein content by weanling pigs, and the nitrogen balances.

Additions to skimmed or watered milk.	Nature of product fed.					Digestibility of product.					Average body weight during trial.	Per 100 kg. live weight.	
	Nutritive ratio.	Protein content.	Fat content.	N-free extract content.	Energy per kilogram.	Protein.	Fat.	N-free extract.	Ash.	Energy.		N digested daily.	N retained daily
		Per ct.	*Per ct.*	*Per ct.*	*Calories.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Kg.*	*Grams.*	*Grams.*
Diafarin	1:2.5	3.97	0.21	9.46	680	91.4	89.5	97.5	81.3	96.3	8.1	137	79.8
Do	1:2.5	4.15	.36	9.63	690	96.8	90.6	98.5	85.7	97.3	6.1	134	83.5
Do	1:4.5	1.51	.14	6.55	362	91.2	91.2	99.2	61.0	97.9	9.9	91	50.9
Do	1:4.6	3.41	.19	15.31	837	94.4	85.8	99.1	63.7	97.8	10.0	110	80.4
Do	1:5.6	2.52	.27	13.57	756	91.2	83.8	98.8	80.1	97.1	12.3	83	66.4
Fat	1:4.3	3.40	4.35	4.90	810	98.1	98.4	98.5	91.5	98.3	9.2	109	77.2
Do	1:5.7	2.57	5.31	3.04	770	97.7	93.5	97.0	92.9	98.1	10.6	66	52.3
Do	1:7.9	1.99	5.98	2.57	778	91.8	93.5	98.1	78.4	94.3	10.7	65	48.1

Dried buttermilk for pigs, J. M. Evvard and R. Dunn (*Duroc Bul. and Live Stock Farmer, 16 (1920), No. 20, pp. 46–48; also in Swine World, 8 (1920), No. 3, pp. 30–32*).—To compare tankage and dried buttermilk as supplements to corn in swine feeding, the authors report a feeding trial at the Iowa Experiment Station involving twenty-four 50-lb. pigs. The pigs were fed in pairs, each receiving tankage or dried buttermilk, or both, in varying proportions.

The pair receiving no buttermilk required 140 days to reach a weight of 225 lbs., made an average daily gain of 1.26 lbs., and consumed 3.15 lbs. of corn and 0.595 lb. of tankage per pound of gain. When dried buttermilk formed from 10 to 30 per cent of the supplement the average daily gain was 1.28 lbs.; the pigs required 3.811 lbs. of feed per pound of gain and the feeding period was reduced very little. When dried buttermilk formed from 40 to 60 per cent of the supplement the necessary feeding period was reduced to about 127 days, the average daily gain was 1.38 lbs. per head, and 3.805 lbs. of feed were required per pound of gain. When buttermilk formed from 70 to 90 per cent of the supplement the necessary feeding period was again slightly reduced, the average daily gain was 1.36 lbs., and 3.58 lbs. of feed were required per pound of gain. The pair fed no tankage required 128 days to reach the 225-lb. weight, made an average daily gain of 1.38 lbs., and required 3.05 lbs. of corn and 0.777 lb. of buttermilk per pound of gain. The twelfth pair, which had free choice of tankage and buttermilk, attained market weight in 120 days, made an average daily gain of 1.45 lbs., and consumed 2.76 lbs. of corn, 0.076 lb. of tankage, and 0.763 lb. of buttermilk per pound of gain.

Comparison of rations for laying hens, Mr. and Mrs. G. R. Shoup (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1921), No. 10, pp. 152–155*).—Four pens of pullets and three of yearling hens were fed for 10 months, beginning December 1, the object being to discover changes in the feeding methods employed at the substation that would reduce the expense and labor without decreasing production. However, neither the omission of sprouted oats, the omission of wet mash, nor the substitution of fish meal for clabbered milk proved to be a desirable change from the standpoint of production and profit. When all the feeds were given in a hopper production and profit were less noticeably lowered,

but the birds showed such a decided preference for the wheat of the scratch feed that it was necessary to supply it in small amounts in order to get them to eat the corn, and the method, therefore, did not result in a saving of labor.

A method of keeping poultry records and accounts, I. L. OWEN (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 4, pp. 4*).—The importance of keeping records of egg production, feed consumption, selling prices of eggs, etc., is emphasized, and sample record blanks are given.

DAIRY FARMING—DAIRYING.

Studies in milk secretion.—VIII, On the influence of age on milk yield and butter-fat percentage, as determined from the 365-day records of Holstein-Friesian cattle, J. W. GOWEN (*Maine Sta. Bul. 293 (1920), pp. 185–196, figs. 2*).—Continuing this series of studies (E. S. R., 44, p. 178), the author reports a statistical investigation of 2,586 semiofficial (yearly) Holstein-Friesian advanced registry records.[1]

Data concerning the relation of milk yield to age were fitted to a curve like that previously used for similar data from other breeds. The equation to this curve is

$$y=11,351.5+873.67\ x-32.225\ x^2+1,548.36\ \log_{10}x$$

where y is the pounds of milk produced in 365 days, and the age (in years) at the beginning of the test is equal to $1.25+0.5\ x$. By this formula the maximum yield occurs at the age of 8 years 4 months and 29 days. The butter-fat percentage seemed to decline uniformly though slightly with age, and the data were fitted to the following straight line:

$$\text{Butter-fat percentage}=3.470-0.009\times\text{age in years.}$$

In both cases the means for the older classes showed considerable dispersion from the plotted curves, due mainly, it is thought, to the relatively few records of very old cows.

The results of this study are discussed with reference to advanced registry requirements.

The effect of pasteurization on the number of bacteria in milk when this is determined by the direct microscopic count, E. G. HASTINGS and A. DAVENPORT (*Jour. Dairy Sci., 3 (1920), No. 6, pp. 494–501, figs. 2*)—The authors report observations at the Wisconsin Experiment Station indicating that the direct microscope count of the bacteria in pasteurized milk does not give a complete picture of the bacterial content of the same milk before pasteurization, since some of the dead organisms lose their staining capacity. In the 16 series of market milk counts tabulated the post-pasteurization counts vary from 18 to 83 per cent of the corresponding raw-milk counts. Preparations of milks inoculated with pure cultures and then pasteurized showed that pasteurization had no effect on the stainability or countability of *Bacilli coli* and *Staphylococcus pyogenes aureus*, that dead *Bacterium bulgaricum* is only faintly stained but completely countable, that *Streptococcus pyogenes*, *Micrococcus* sp., and *B. lactis acidi* are faintly and unevenly stained and are not all visible, that only an occasional cell of *Bacillus anthracis* is stained and visible, and that no *B. subtilis* is stained.

The relative value of the methylene blue reduction test, the bromthymol blue test, and the bromcresol purple test in determining the keeping quality of milk, E. G. HASTINGS and A. DAVENPORT (*Jour. Dairy Sci., 3 (1920), No. 5, pp. 353–366*).—This is a continuation of previous work at the Wisconsin Ex-

[1] Advanced Reg. Holstein-Friesian Assoc. Amer., 18–28 (1907–1917).

periment Station on the value of the methylene blue reduction test (E. S. R., 42, p. 472).

It was found that this test is a more accurate measure of the number of bacteria in milk than either the bromthymol blue test of Cooledge and Wyant (E. S. R., 43, p. 615) or the bromcresol purple test of Baker and Van Slyke (E. S. R., 43, p. 579). It is pointed out that the latter tests depend on the measurement of acid, one of the by-products of the growth of bacteria, whereas the reduction of methylene blue depends upon the number of living cells.

An unusual outbreak of ropy milk, B. W. Hammer and W. A. Cordes (*Jour. Dairy Sci., 3 (1920), No. 4, pp. 291–299*).—The occurrence of a ropy condition in the cream and to a less extent in the milk produced on an Iowa farm was found to be due to *Staphylococcus cremoris-viscosi* n. sp. The cultural and morphological characters of the causal organism showed it to be closely related to *Micrococcus mucofaciens* (E. S. R., 28, p. 581). The organisms were definitely spherical in shape and fairly constant in size, the extreme diameters being 0.7 and 1.2 μ. Under the microscope it was seen that material much like the capsular material of *Bacterium viscosum* was secreted, but this was rapidly taken up by the surrounding medium instead of being retained near the cell as a definite capsule.

The outbreak was unusual in that it occurred in January. Some time after the trouble had abated the causal organism was isolated from the udder of cows in the herd producing the original samples, but it was impossible to determine whether the udder was the primary source of infection.

Is ropy milk becoming a more serious dairy trouble? H. A. Harding and M. J. Prucha (*Jour. Dairy Sci., 3 (1920), No. 6, pp. 502–521*).—The authors give a more detailed account of the epidemic of ropy milk reported in Illinois Experiment Station Bulletin 228 (E. S. R., 43, p. 579), and state that the causal organism belongs to the *Bacterium aerogenes* group. In cultures it was found to be more resistant to heat than an old culture of *B. viscosum* isolated from ropy milk supplied from another company. In some cases it was not killed by 20 minutes' exposure to 140° F. From a survey of the numerous recent outbreaks of ropy milk, it is concluded that the causal organisms have not taken on new vigor nor are they more widely disseminated than formerly, but that modern methods of handling milk to prevent souring provide new opportunities for the kind of fermentation produced by the ropy milk organisms.

A comparison of the butter fat content and the total solids content of creams of varying richness separated from the same sample of milk, B. A. Stiritz and O. R. Overman (*Jour. Dairy Sci., 3 (1920), No. 6, pp. 522–528, figs. 2*).—The authors tabulate and discuss determinations made at the Illinois Experiment Station of the percentages of fat (Roese-Gottlieb method) and total solids (Official method) in 72 samples of cream and in the 14 lots of milk from which the cream samples were derived. Mixed milks and milks from Jersey, Guernsey, Ayrshire, and Holstein herds were used and four makes of separators.

It was found that the proportion of solids-not-fat in cream of a given fat content was relatively constant, despite the great variations in the initial milk samples. When fat percentages were plotted against percentages of total solids the graph was approximately a straight line, but it is claimed that a simple linear relationship between percentage of butter fat and percentages of solids-not-fat, is not so clearly indicated. The common rule that

$$\text{percentage of solids-not-fat}=0.089\times(100-\text{percentage of fat})$$

is held not to be sufficiently accurate for determining solids-not-fat in cream for ice-cream making. The rule tends to give an overestimate of solids-not-fat in thin cream and an underestimate in thick cream.

Comparison of the decantation method with other methods for the determination of fat in butter, O. R. Overman and Saichi Okimoto (*Jour. Dairy Sci., 3 (1920), No. 5, pp. 425–429*).—Eight lots of butter were analyzed for water and fat at the Illinois Experiment Station by the Official method and by Kohman's gasoline extraction (decantation) method (E. S. R., 40, p. 311). The fat was also determined by the Roese-Gottlieb and the Mojonnier methods. It was found that the Kohman method gave results remarkably close to the Official method, differing from it in some cases by amounts of the same order as the difference between duplicate samples analyzed by the Official method. The authors emphasize the fact that the Kohman method is very simple and requires but little skill in manipulation.

A study of the incorporation of proteins in creamery butter, R. W. Wyant (*Jour. Dairy Sci., 3 (1920), No. 6, pp. 452–467*).—This is a report on experimental churnings at the Michigan Experiment Station. In each case the batch of cream was divided into two portions, one churned normally as a control, and the other churned with some deviation from standard practices in washing or working the butter.

In 4 cases no wash water was added after the buttermilk was drained off, and the butter was also subjected to fewer revolutions during the working process than the control butter. The experimental butters contained 0.55, 0.54, 0.53, and 0.45 per cent of protein, respectively, when finished, while the corresponding controls contained 0.38, 0.4, 0.44, and 0.32 per cent. In 3 experiments the butter was worked in the buttermilk and was not washed. The protein content of the experimental butters was 0.56, 0.52, and 0.51 per cent, respectively, and in the corresponding controls 0.42, 0.37, and 0.35 per cent Starter was worked into the butter of one churning and the protein content was 0.47 per cent, the control percentage being 0.32. In none of these cases was the experimental butter discriminated against on the market, and it is concluded that it is impossible in ordinary creamery practice to incorporate a high proportion of curd in the butter.

In a small-scale experiment it was found that the protein content of 0.95 per cent could be obtained by churning very ripe cream at 70° F., but the product graded as unsatisfactory dairy butter.

Factors influencing the viscosity of sweetened condensed milk, L. A. Rogers, E. F. Deysher, and F. R. Evans (*Jour. Dairy Sci., 3 (1920), No. 6, pp. 468–485, figs. 3*).—This contribution from the Dairy Division of the U. S. Department of Agriculture is a study of the factors producing the type of increased viscosity in condensed milk in which the thickening is uniform throughout the can and is not caused by bacterial action.

The protein content was found to be the most important factor in inducing viscosity, since experimental condensed milk made from skim milk from which most of the casein had been precipitated did not increase in viscosity during storage, whereas control milk became much thickened. The addition of phosphates also caused a distinct acceleration in viscosity. High forewarming temperatures and high storage temperatures increased the tendency of milk to thicken, but no evidence was obtained that acidity, contained air, or copper salts had any important influence on the viscosity. The cane-sugar concentration, although influencing the initial viscosity, did not of itself effect any increase in viscosity.

The viscosities were determined by means of a torsion viscosimeter devised by W. M. Clark. The container for the fluid is kept revolving at a constant speed, and the rotation produced in a cylinder suspended in the fluid is read from a pointer moving over a graduated circle.

VETERINARY MEDICINE.

Experimental bacteriology and infectious diseases, I, II, W. KOLLE and H. HETSCH (*Die Experimentelle Bakteriologie und die Infektionskrankheiten. Berlin and Vienna: Urban & Schwarzenberg, 1919, 5. ed., rev., vols. 1, pp. XVI+660, pls. 42, figs. 142; 2, pp. VIII+661–1363, pls. 66, figs. 201*).—This is the fifth revised edition of this reference book on infectious diseases, the fourth edition of which has been previously noted (E. S. R., 27, p. 76).

The first 14 chapters of the first volume are of a general nature dealing principally with immunological problems and methods for serum diagnosis and sero- and bacterio-therapy, while the remaining chapters of the first volume and the whole of the second volume deal with individual diseases.

Epizootics and their control during war, H. MIESSNER (*Kriegstierseuchen und ihre Bekämpfung. Hanover: M. & H. Schaper, 1918, 3. ed., rev. and enl., pp. XVI+378, figs. 105*).—This is the third enlarged German edition of this work, the English edition of which has been previously noted (E. S. R., 38, p. 287).

Pathological physiology, L. KREHL (*Pathologische Physiologie. Leipzig: F. C. W. Vogel, 1920, 10. ed., pp. XII+790*).—A tenth edition of this work.

Guide for meat inspectors, R. VON OSTERTAG (*Leitfaden für Fleischbeschauer. Berlin: Richard Schoetz, 14. ed., rev., 1919, pp. XIV+296, figs. 199*).—This is a new edition of this work, the first English edition of which has been previously noted (E. S. R., 32, p. 777).

Daubentonia longifolia (coffee bean), a poisonous plant, C. D. MARSH and A. B. CLAWSON (*Jour. Agr. Research [U. S.], 20 (1920), No. 6, pp. 507–513, pl. 1*).—The authors here report particularly upon feeding experiments with the coffee bean, conducted by the Bureau of Animal Industry, U. S. Department of Agriculture, during the summers of 1918 and 1919. A general summary of knowledge of this plant and of poisoning by it has been previously noted (E. S. R., 42, p. 879).

"The plant is found on sandy soils from Florida to central Texas and as far north as the northeastern border of Texas. In some places, as in the lower Rio Grande and San Antonio regions, it is very abundant. In Houston and vicinity it is common along the roadsides and in waste places. Farther east it is confined rather closely to the Gulf region."

A summary of the feeding experiments with sheep here reported is presented in tabular form. "In the animals poisoned, degenerative tissue changes occur principally in lymphoid tissues, smooth muscle, and in the red-blood corpuscles. The more delicate cells of the lymph nodules are almost universally found to have undergone degeneration. Tissues composed of smooth muscle fibers are similarly though perhaps not so conspicuously affected. In the blood stream are many thrombi containing degenerated erythrocytes, granular material, and often fibrin. Probably the degenerative changes in the erythrocytes and lymphoid tissues are the most important causes of the thrombus formation. Small hemorrhages due to ruptured vessels are not uncommon. Weakening of the muscle layers of the vessels, together with thrombi in the vessels, would appear to be a sufficient cause for the rupture of the vessel walls. Degenerative changes also may occur in various glands, as the kidney and liver, but they are less severe than those in the tissues described.

"The smallest dose producing death in the experimental work was that given to sheep 550, which received 0.11 lb. (49.89 gm.) per hundredweight of animal. The smallest dose producing symptoms was that given to sheep 548, 0.066 lb. (29.9 gm.) per hundredweight of animal. Inasmuch as sheep 523 received

0.066 lb. (29.9 gm.) per hundredweight without effect, it appears that this quantity is about the lowest limit of toxicity."

The experiments show clearly that the toxic substance present is excreted very slowly, so that poisoning may result from the repeated administration of quantities somewhat below the toxic dosage. Two experiments in which dried leaves were fed to sheep show that as compared with seed they are much less toxic. The toxic substance was shown to be present in the dry pods, but as compared with the seeds the pods are only slightly toxic and not likely to cause any damage to live stock.

A comparison of the effect of certain saponins on the surface tension of water with their hemolytic power, H. E. WOODWARD and C. L. ALSBERG (*Jour. Pharmacol. and Expt. Ther., 16 (1920), No. 3, pp. 237–245*).—"The lowering of the surface tension of Locke solution [NaCl 9.2, KCl 0.42, $CaCl_2$ 0.26, and $NaHCO_3$ 0.15 grams per liter] by 12 saponins was measured. The lowest concentration at which these saponins hemolyze was determined. The surface tension effect and the hemolytic power of these saponins are not parallel."

Standardization of disinfectants with special reference to those used in the chemical sterilization of water, S. R. CHRISTOPHERS, K. R. K. IYENGAR, and W. F. HARVEY (*Indian Jour. Med. Research, 7 (1920), No. 4, pp. 803–809*).—"The suspension of organisms used in testing disinfectants should be one of naked organisms in a menstruum containing no organic matter; special coefficients should be devised for the evaluation of the effect of organic matter. The quantity of organisms contained in unit volume of the suspension is a necessary datum in the evaluation of a coefficient of efficacy. Iodin is a better indicator to use (at all events for the testing of water sterilizing substances) than the commonly used carbolic acid. It has several advantages over carbolic acid which might render it preferable to carbolic acid in other cases than that mentioned. Coefficients of stability, price, portability, poisonous character, etc., are required to complete the description of a disinfectant."

The value of normal sera in anthrax infection, F. GERLACH (*Centbl. Bakt. [etc.], 1. Abt., Orig., 84 (1920), No. 5, pp. 396–400*).—Attempts to protect guinea pigs with normal horse serum against artificial anthrax infection were unsuccessful, while the control animals inoculated with immune serum in most cases survived the anthrax infection. These results are thought to confirm the conclusions of Hutyra and Manninger (E. S. R., 43, p. 181) that the protective results reported by others with the use of normal sera must indicate a natural immunity of the animal furnishing the serum.

The occurrence of normal precipitins for blackleg in the blood serum of various animals, A. KOEGEL (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 20 (1920), No. 4, pp. 351–357*).—Precipitins for blackleg were found in the blood of normal goats, kids, sheep, lambs, cows, and calves, but not in the blood of normal rabbits, dogs, and horses. The reaction was stronger in the blood serum of young animals than of old, and somewhat weaker in normal animals than in those immunized against blackleg.

It is pointed out that these results agree with the fact that ruminants are more susceptible to blackleg than are other animals. The stronger reaction in young animals is thought to indicate that alimentary and passive immunity is in general of short duration.

The white blood picture in glanders, H. WITTE (*Monatsh. Prakt. Tierheilk., 31 (1920), No. 9–10, pp. 429–446*).—From a microscopical study of the blood of horses suffering from glanders, the author concludes that the disease is almost invariably accompanied by a hyperleucocytosis with an absolute increase in the neutrophilic leucocytes. This is not the case with animals in the first stages of, or in those recovered from, the disease.

Cattle plague, or rinderpest, in Belgium and the measures taken to protect French herds, A. MASSÉ (*Compt. Rend. Acad. Agr. France, 6 (1920), No. 29, pp. 719–726*).—This is a brief account of the manner in which rinderpest was introduced into Belgium, through debarkation at the port of Anvers of zebus on their way to South America from India, and of the measures being taken to prevent its spread.

A spontaneous epidemic among laboratory rabbits caused by a paratyphoid B bacillus related to the rodent group, V. M. LITCH and K. F. MEYER (*Jour. Infect. Diseases, 28 (1921), No. 1, pp. 27–42, figs. 2*).—This is a detailed report of the history of an epidemic, symptoms, lesions, etc. The disease was introduced, but it was impossible to determine its origin. It was definitely shown by the serologic tests that the bacillus does not antigenically belong in the human paratyphoid or *Bacillus schottmülleri* group.

Relation between the virulence of streptococci and hemolysin, F. A. STEVENS, J. W. S. BRADY, and R. WEST (*Jour. Expt. Med., 33 (1921), No. 2, pp. 223–230, fig. 1*).—"Strains of streptococci whose virulence has been increased for any one species of animal do not produce greater concentrations of hemolysin than the original strain. Furthermore, there is a tendency for the original culture to grow more rapidly than the more pathogenic form, and to reach the height of hemolysin production at an earlier stage during the growth of the culture. These conclusions can probably be applied only to experiments in which the serum used in the media is from some species not employed for the animal passages."

The resistance of streptococci to germicidal agents, H. ALBERT (*Iowa Acad. Sci. Proc., 26 (1919), pp. 77–83*).—"The most efficacious of the germicides tested are as follows: Alcohol (50 or more per cent), chloramin–T, dichloramin–T, iodin, mercuric chlorid, and thymol. Certain commonly employed germicides, as boric acid and hydrogen peroxid solution, were found to be of very little value.

"Iodin is very effective even in a high dilution and in the presence of a moderate amount of albuminous material. In a solution of 1 : 2,000 it destroyed all streptococci suspended in water, and in a solution of 1 : 1,000 all of them suspended in an albuminous solution within one-fourth minute. It would seem that it would be advisable to use very much more dilute solutions of iodin than are ordinarily employed, especially since the more concentrated solutions are both irritating and destructive of tissue cells.

"The presence of albuminous fluid very markedly reduces the germicidal effect of a number of agents, of which chloramin–T and thymol may be mentioned as examples. There does not seem to be a 'specific' germicide for streptococci."

Experimental streptococcus empyema.—II, Attempts at dye therapy, F. P. GAY and L. F. MORRISON (*Jour. Infect. Diseases, 28 (1921), No. 1, pp. 1–17*).—This paper consists of a discussion of dye therapy as illustrated by references from the literature and by experiments in vitro and in vivo undertaken to determine the possibilities of dye therapy for the experimental streptococcus empyema in rabbits described in the first paper of the series (E. S. R., 42, p. 778).

A systematic study of the bactericidal effect of certain dyestuffs in vitro upon streptococcus pus, and of the action in vivo of the few substances found active in vitro led to the selection of acriflavin as being the most promising. This was particularly owing to the fact that it is bactericidal in protein mixtures, does not inhibit phagocytosis, penetrates tissues, and gives rise to no dye fastness in bacteria.

Although this dye could be given in a dosage many times greater than its bactericidal titer in vitro, and killed the organisms to such an extent that the

pleural fluid often became nearly sterile, regrowth of the organisms always occurred and in no instance was the life of the animals prolonged. Combinations of immune serum and acriflavin were also without success in prolonging the life of the animal. These results are thought to indicate that no practical therapeutic results may be expected from the use of dyestuffs in empyema due to the streptococcus.

The preparation and preservation of germ-free vaccines, especially blood vaccines, B. Möllers (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 81 (1918), pp. 347–353*).—Various methods in use for preserving and sterilizing vaccines are discussed, and the conclusion is drawn that for blood sera (antitoxins, etc.) as well as for the vaccines which consist of suspensions of killed bacterial cultures in salt solution, the addition of 0.5 per cent of phenol is the best means of preservation. Vaccines prepared from whole blood can be kept germ-free by the addition of 0.2 per cent formalin.

The blood precipitation test for the diagnosis and prognosis of tuberculosis, S. Fuchs von Wolfring (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 81 (1918), pp. 178–191, figs. 14*).—The author describes and discusses the value in the diagnosis of tuberculosis of the precipitation test, using whole blood instead of serum. The precipitation is effected in varying dilutions of blood with a test solution of an emulsion of tubercle bacilli in carbolized salt solution, duplicate tests being made with the diluted blood and carbolized salt solution without the emulsion of tubercle bacilli. The value of the test is thought to lie in the comparison of the specific precipitation, or precipitation in the presence of tubercle bacilli, with the autoprecipitation, or precipitation in the absence of foreign tubercle bacilli. If the former is greater at a given dilution of blood than the latter absence of tuberculosis is indicated, while the contrary shows the presence of tuberculosis. The progress of the disease can thus be watched by the changing ratios of these two values.

A chart is given of the results of this method in 1,200 cases illustrating different types.

Studies on immunity to tuberculosis, A. K. Krause et al. (*Amer. Rev. Tuberculosis, 4 (1920), No. 8, pp. 551–591, pls. 2*).—Continuing the series of studies on immunity to tuberculosis (E. S. R., 41, p. 190), two papers are presented.

A description of graphic records of the local allergic and immune reactions to tuberculous reinfection in guinea pigs, A. K. Krause and D. Peters (pp. 551–562).—In this contribution the authors discuss the phenomena of local allergy and immunity to tuberculosis from a series of graphic representations of the local reactions following the intracutaneous injection of virulent tubercle bacilli, under carefully controlled conditions, into normal (nontuberculous) guinea pigs and into guinea pigs already tuberculous at the time of the skin infection. The lesions in the first series of animals thus represent the phenomena of primary infection and in the second series of reinfection.

A comparison of the colored sketches of the lesions in the normal and tuberculous animals at one-week intervals showed the following sharp points of contrast: The tuberculous animals showed an immediate reaction with an early development of nodule, tending soon to come to a standstill, retrogress, and heal. The nontuberculous controls showed later development of nodule, the lesions not beginning to develop rapidly until those of the tuberculous animals had come to a standstill, and still persisting and progressing after the others had healed.

These points of difference are discussed in detail from the standpoint of allergy and immunity. The authors are of the opinion that while immunity to reinfection is largely the result of bacteriolysis accompanying the manifes-

tation of allergic exudation at the site of infection, the accelerated development of tubercle also plays a part in the mechanism of immunity.

The results of virulent reinfection into tuberculin-reacting areas (skin) of tuberculous guinea pigs, A. K. Krause and H. S. Willis (pp. 563–591).—In an effort to determine the part played by inflammation in hindering or abetting tuberculous infection, guinea pigs were rendered tuberculous by inoculation with living tubercle bacilli of the human type, and at the height of sensitiveness to tuberculin received injections of tuberculin. Several groups of these animals were then infected by intracutaneous injections into the tuberculinized areas at different stages of the tuberculin reaction and on the same and opposite sides as the primary infection. The results obtained with these and various controls are summarized in tables in which the local and generalized lesions are described. The main deductions from these data are given as follows:

"If, because of an existing tuberculous infection, an animal (guinea pig) has acquired a given degree of allergy and immunity, both of these are reduced under the following conditions: They are reduced at the site of an inflammatory tuberculin reaction for at least four days after the application of the tuberculin. They are more reduced by inflammatory tuberculin reactions at places which are within the lymphatic drainage area of tuberculous foci than at places which are not so situated. They are reduced to a greater extent shortly (one to two days) after the application of tuberculin than later (four days after tuberculin). The part played by the inflammation of the allergic reaction, considered purely by itself, remains undisclosed."

Attempts at immunization against tuberculosis with massive doses of antigen, Uhlenhuth and Joetten (*Deut. Med. Wchnschr.*, *46* (*1920*), *Nos. 32, pp. 877–879; 33, pp. 901, 902*).—This is a brief report of a series of attempts to immunize rabbits and guinea pigs against artificial tuberculosis infection of both the human and bovine type. The methods included the use of tubercle bacilli treated with trichlorethylene to remove the waxy material, bacilli treated with antiformin, pulverized bacilli, bacilli treated for two hours in steam at 100° C. or held for one-half hour at 150°, and finally the use of living turtle tubercle bacilli.

All of these antigens failed to produce immunity against tuberculosis. In a few cases a heightened resistance against infection resulted, but in many the treated animals succumbed to the infection before the controls. The irregularity of results is emphasized as illustrating the necessity of using as large a number as possible of experimental animals in order to avoid drawing wrong conclusions.

In conclusion, the authors discuss the distinction between immunity and heightened resistance, pointing out that in some diseases such as syphilis and tuberculosis there is more resistance to a new infection during the progress of the disease than after a cure has apparently been effected, when the body becomes more susceptible to new infection.

The use of avian tuberculin for the detection of paratubercular enteritis in cattle, T. Krautstrunk (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 20* (*1920*), *No. 4, pp. 267–286*).—Data are presented indicating that avian tuberculin is of value in the early diagnosis of paratubercular enteritis in cattle (Johne's disease), the number of incorrect diagnoses being no higher than in the regular tuberculin test for tuberculosis. For the control of the disease it is recommended that the entire herd be tested yearly and all reactors isolated. Severe cases should be disposed of and care taken to prevent infection through contaminated feed and water.

Bovine tuberculosis eradication, C. N. McArthur (*Cong. Rec., 60 (1921), No. 38, pp. 1881, 1882*).—This is an address delivered in the House of Representatives in which the status of the work is briefly summarized and its importance emphasized.

List of accredited herds and herds which have passed one tuberculin test, S. E. Bruner (*Penn. Dept. Agr. Bul. 343 (1920), pp. 25*).—This list records the Pennsylvania herds accredited under the officially accredited plan adopted early in 1918; also those that have passed successfully one negative test.

The blood of cattle with pleuropneumonia, tuberculosis, and septic affections, A. Schwanitz (*Monatsh. Prakt. Tierheilk., 31 (1920), No. 5–6, pp. 193–250*).—This report of studies conducted at the medical clinic of the veterinary college in Berlin includes a list of 23 references to the literature.

Practical experiments on the value of immunization against hog cholera, W. Pfeiler (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 20 (1919), Nos. 1, pp. 1–25, figs. 5; 2, pp. 132–171, figs. 7; 3, pp. 218–259, figs. 6*).—This is the report of a detailed investigation conducted in 1912 of the value of serum vaccination against hog cholera. The percentage of mortality was so high among the vaccinated animals that the author concludes that the method is of little value as a protective measure. Lack of experimental animals prevented a trial of the simultaneous serum vaccine treatment.

Observations on an epizootic contagious catarrh of the respiratory organs of equines and its relation to purpura hemorrhagica, A. Theiler (*Union So. Africa, Dir. Vet. Research Rpts. 7–8 (1918), pp. 361–393*).—This is a report of studies of a disease of horses, mules, and donkeys which appeared in September, 1916, almost simultaneously in the different towns of South Africa, affecting the greater number of these animals. It appeared in horses and mules as a catarrh of the respiratory organs of a fairly benign nature, developing in some cases into broncho-pneumonia, while in others purpura hemorrhagica was observed as a sequel. In donkeys it was complicated with a hemorrhagic pneumonia of a fulminant and frequently fatal type in a great number of instances.

The contagious catarrh was characterized in the main by a set of symptoms which were all present in the greatest number of cases, viz, fever, nasal discharge, and cough. In some cases an affection of the lungs could clinically be diagnosed or from the course of the temperature curve had to be surmised. A fatal issue was observed to be due to either a broncho-pneumonia or to purpura hemorrhagica.

The author concludes that this disease observed in South Africa will have to be identified with that specific disease in which purpura hemorrhagic is a sequel. This disease, based upon the literature, is neither the epizootic catarrh nor the influenza catarrhalis described by Hutyra and Marek, but might be the light form of influenza of Hoare. It is thought that this light influenza may be an entity of its own.

Under the heading of casuistics, reports upon 66 animals are appended.

Chicken pox or contagious epithelioma, W. T. Johnson (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1921), No. 10, pp. 156–160, figs. 5*).—In addition to material previously noted (E. S. R., 42, p. 886), this article includes a description with illustration of a type of syringe recommended and furnished at cost by the station to poultrymen in the State.

Paratyphoid bacilli from chicks, R. S. Spray and L. P. Doyle (*Jour. Infect. Diseases, 28 (1921), No. 1, pp. 43–47*).—This is a contribution from the Indiana Experiment Station, which has been summarized by the authors as follows:

"In this study of freshly isolated paratyphoids from chickens we have found 20 strains from chicks showing lesions of bacillary white diarrhea and two

strains from diseased ovaries of hens to be identical with a type strain of *Bacterium pullorum*. One new type was encountered which closely resembled the *Bacillus paratyphosus* B type, but which was agglutinatively distinct, and appeared to have commonly only a single polar flagellum; some cells doubtfully displayed a second.

"Constant lesions were associated with the presence of these organisms; enlargement of the liver, together with petechiæ and necrotic foci in the liver, and pneumonia and yellow friable nodules in the lungs were characteristic. Abscesses in the cecum were found occasionally.

"One strain isolated from a chick fermented the proper sugars, but did not produce gas from any. All other strains produced gas from one or more sugars. No correlation could be shown in gas production from various sugars; some strains produced gas from glucose and not from mannite; the behavior of others was exactly the reverse. Repeated tests were necessary to demonstrate gas production by some strains. All of our strains and the control strain of *B. pullorum*, usually regarded as unable to ferment maltose, produced acid and gas in 1 per cent maltose serum water. Maltose infusion broth was not fermented."

A revision of the nematode family Gnathosotomidæ, H. A. Baylis and C. Lane (*Zool. Soc. London Proc., 1920, III, pp. 245–310, pls. 7, figs. 40*).—The species of all the genera of this family are parasitic in the alimentary canal of their hosts, usually in its anterior part, and show a greater or less tendency to adopt a habit of burrowing in the tissues. "Some of them are not infrequently found buried completely in the stomach wall, where tumors tend to be formed round them at the expense of the host. Others, while not penetrating to this extent, obtain a very firm hold by burying their heads in the mucous membrane. One genus (Gnathostoma) has been found as a rare, and probably abnormal, parasite of man, its habitat in this case being the subcutaneous connective tissue and not the alimentary canal." Two new subfamilies are erected and three species are described as new. A list of references covering three pages is included.

RURAL ENGINEERING.

Exploratory drilling for water and use of ground water for irrigation in Steptoe Valley, Nev., W. O. Clark and C. W. Riddel (*U. S. Geol. Survey, Water-Supply Paper 467 (1920), pp. 70, pls. 6, figs. 6*).—Following an introduction by O. E. Meinzer on ground water for irrigation in Nevada, the results of studies of the ground-water resources of an area of 900 square miles in east-central Nevada are reported.

The soils of Steptoe Valley are divided on the basis of texture into gravelly, sandy, and clayey soils, and on the basis of chemical composition into alkali and nonalkali soils. The ground water of the area is said to occur for the most part in the unconsolidated valley fill, and the exploratory drilling demonstrated the existence in the valley fill of beds of gravel that will yield large supplies of water, such as are required for practical irrigation. The depth to the water table ranges from only a few inches in some of the lower parts of the valley to 250 ft. or more on the outer edges. Over an area of approximately 75,000 acres the water table stands less than 8 ft. below the surface. It is stated that the known facts apparently warrant the statement that the average annual contribution to the supply of ground water in the valley is not less than 50,000 acre-feet.

Analyses of several samples of water from test wells in the valley showed that they were of good quality for irrigation and also in general of good

quality for domestic use. Considerable data on springs and wells in the valley are included.

Ground water in the Norwalk, Suffield, and Glastonbury areas, Conn., H. S. Palmer (*U. S. Geol. Survey, Water-Supply Paper 470 (1920), pp. 171, pls. 12, figs. 18*).—This report, prepared in cooperation with the Connecticut Geological and Natural History Survey, deals with the ground-water resources in the neighborhood of 13 towns in three areas, one in the southwest corner, one in the central part, and one at the northern boundary of the State. A summary of the geology of these areas is given, as related to the occurrence of ground water, and methods are described for the recovery of ground water, together with detailed data for the 13 towns.

Considerable data on the composition of well waters and on different wells in the areas are included.

Surface water supply of New Mexico, 1917, J. A. French (*Santa Fe, N. Mex.: State Engin. Dept., 1917, pp. 153*).—This report presents the results of measurements of flow made on streams in nine river basins in New Mexico during 1917.

Velocity tests in hydraulic dredge pipe, I. E. Houk (*Engin. News-Rec., 86 (1921), No. 1, pp. 18, 19, fig. 1*).—Tests to determine proper values for the coefficient of roughness n in Kutter's formula for hydraulic dredge pipe are reported. With clear water average values for n of 0.01, 0.011, and 0.0111 were obtained in three sets of tests. Large solids in the pipe were found to lag behind the main stream, their velocities sometimes being as low as 77 per cent of the water velocities.

Drainage for plantations, C. Bald (*Calcutta: Thacker, Spink & Co., 1919, pp. [4]+57, figs. 10*).—The object of this practical treatise is to set forth those features of drainage and drainage methods which are specially applicable to plantations in the Tropics. The scope of the book is indicated by chapters on wet soil, causes of wetness, effects of drainage, methods of drainage, and underground drainage .

Clear more land, J. Swenehart (*Wisconsin Sta. Bul. 320 (1920), pp. 27, figs. 20*).—Popular information on land clearing based on experience at the station is given. Generally, brushing is the first step, followed by seeding to grass and pasture or cutting hay until the fibrous roots of the stumps have decayed. It is stated that the cost of stumping varies with the number of years since the tree was cut, the kind, condition, and size of stump, the nature and wetness of the soil, and the number of stumps to the acre. Explosives are considered more or less essential, and low-grade dynamites are deemed better and cheaper than the higher grades.

The use of stump pullers and pilers is described, and specifications for a homemade piler are given. A table is included showing briefly methods and equipment most suitable for pulling different kinds of stumps.

Road-making materials of Mississippi, E. L. Lowe (*Miss. State Geol. Survey Bul. 16 (1920), pp. 139, fig. 1*).—This is a technical and statistical report on the road-building materials of Mississippi. The structural materials of the State consist of limestone for building purposes, for the manufacture of lime and cement, and for road metal; sandstones and ironstones for building purposes and for road metal; and cherts, sand, and gravel for concrete and road metal.

A large amount of test data of these materials, made mainly by the Bureau of Public Roads of the U. S. Department of Agriculture, is included.

Road materials of Nebraska.—III, Soil and subsoil, G. E. Condra (*Nebr. Univ., Nebr. Conserv. and Soil Survey Bul. 10 (1919), pp. 61, figs. 45*).—This

paper outlines the soil provinces of Nebraska, and discusses the physical properties of soils and subsoils much used in road building.

Report on road materials along the St. Lawrence River from the Quebec boundary line to Cardinal, Ontario, R. H. Picher (*Canada Dept. Mines, Mines Branch Bul. 32 (1920), pp. [3]+65, pls. 5*).—The results of a road material survey are reported, made over an area from 4 to 5 miles in width and about 50 miles long, extending from the Quebec boundary line to Cardinal, Ontario.

The available road materials were found to be bedrock, field stone, and gravel. Rock exposures are of small extent and occur only in a few places. The bedrock is considered to be probably the best road material, although laboratory tests showed that the field stone in certain localities is nearly equivalent to it in durability. The proportion of durable material in the bowlder deposits of field stone increased regularly from the east to the west end of the area. The bowlder deposits are usually of better quality than the gravel deposits. The bedrock, most of the field stone, and some of the gravel deposits are considered to be suitable materials for broken stone or gravel roads under ordinary country traffic conditions, but none of them would be sufficiently durable to be used on roads subjected to fairly heavy traffic. A considerable amount of laboratory test data is included.

Excess lift as a factor in highway transportation, R. C. Barnett (*Engin. and Contract., 55 (1921), No. 1, pp. 21–23, figs. 6*).—A mathematical analysis of the excess lift factor in highway transportation is given, showing it to be of considerable importance in economic transportation.

It is concluded that the analysis indicates the need for more careful study of proposed alignments and grades. A table is given showing the distance that a load may be moved over different roads, using the same amount of energy that would be required to lift it 1 ft. vertically. This shows that the better classes of pavements have higher equivalents, indicating the great importance of reducing excess lift before such road surfaces are constructed.

The artificial seasoning of timber in estate timber yards, A. J. Wallis-Tayler (*Jour. Roy. Agr. Soc. England, 80 (1919), pp. 145–149, figs. 2*).—Timber drying plants suitable for use in an estate timber yard in England are described.

Preservative treatment of wood poles, R. V. Achatz (*Purdue Univ., Engin. Dept. Circ. 2 (1920), pp. 54, figs. 18*).—The results of a survey of conditions in Indiana relative to the treatment of wood poles are reported, together with experimental data on methods and results of treatment.

It was found that a considerable percentage of the poles for electrical service erected at the present time in the State are receiving some kind of treatment. The most commonly used preservatives are coal-tar derivatives, the most satisfactory being creosote oil and the higher boiling oils known as carbolineums. Coal tar itself should not be used, and mixed creosote oils containing undistilled products are not recommended. The commonly used treatments are the brush and open tank. Poles of less durable woods treated by the pressure-tank process are more expensive than butt-treated cedar and chestnut poles and are not extensively used.

A study of the economics of pole preservation shows that under average conditions an increase in life of about two years will justify brush treatment, about 3.5 years will justify open-tank dipping treatment in hot creosote, and about 7.5 years will justify the hot and cold bath open-tank treatment.

The most commonly used method to increase the life of poles in service is to reinforce by setting a creosoted stub beside the weakened pole and to bind the

two together by wire. Another method used is to brush treat the base of the pole after excavating the earth and clearing away decayed wood.

The selection of the proper method of treatment depends upon local conditions. For the lighter lines or where first cost is an important consideration, brush treatment offers some advantage. The open-tank dipping process gives greater uniformity and probably somewhat longer life than the brush treatment. The hot and cold bath open tank treatment gives the greatest increase in life, and is considered to be especially suitable for heavy lines and permanent construction. Specifications are appended for the purchase of preservatives and for the application of the treatments recommended.

The utilization of wood waste, E. HUBBARD, trans. by H. B. STOCKS (*London: Scott, Greenwood & Son, 1920, 3. ed., rev. and enl., pp. XII+236, figs. 51*).—This is the third revised and enlarged edition of a translation from the German of this book (E. S. R., 35, p. 148), covering numerous methods for the utilization of wood waste. It deals, among other subjects, with the use of sawdust as fuel, for the manufacture of alcohol, explosives, and gunpowder, and as a source of potash.

Water gas and coal gas tar paints, J. HINDS (*Reclam. Rec. [U. S.], 12 (1921), No. 1, pp. 21-23*).—Different experiments by the U. S. Reclamation Service on the preservation of irrigation structures by paints are reviewed, showing that tar paint is superior to any other paint for all kinds of submerged metal work. It is also considered very satisfactory for use on wood structures or in any place where a black paint with a slightly sticky surface is not objectionable. It is economical in first cost and is said to be easily and cheaply applied.

Agricultural tractors and war tractors: The problem of adhesion, C. JULIEN (*Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 10 (1919), No. 7-9, pp. 785-803, figs. 27*).—Considerable data on the gripping devices of driving wheels of European tractors are given.

Theory and practice are said to agree in showing that the use of angle pieces placed on the rims of the wheels restricts the possibilities of the utilization of the available engine power for useful work, thus indicating that the types of wheels which should give the best results from the haulage viewpoint are those which have external projections of the largest size and the most effective means for continuous cleaning. It is concluded that the most efficient wheels are, on the one hand, those with narrow rims and wide plates projecting beyond both edges of the rims, and, on the other hand, those with wide controlled plates sliding in a slit in the rim which ordinarily cleans them.

Farm tractor conditions in the United States (*Farm Machinery—Farm Power, No. 1514-15 (1921), pp. 13-15, 18*).—Reports from 20 State agricultural colleges on the various phases of power farming in the different States are summarized, indicating that farmers generally are convinced of the practicability of the tractor and that objections of three years ago are fast disappearing.

Tractors in Florida, F. ROGERS (*Fla. Univ. Ext. Circ. 12 (1920), pp. 8*).—An economic report on 93 tractors of 11 different makes and 6 different sizes in Florida is given.

Of the 93 tractors studied, 72 were considered profitable and 12 unprofitable. No report was received regarding 5, and the remainder were not decided upon. It is brought out that the percentage of satisfaction would be greater with more efficient operators.

The principal advantage of the tractor was found to be its ability to do a great amount of work in a short time and the principal disadvantage the exces-

sive wear of parts. The average reduction of horses due to tractors was 3.3 for 66 farms, and 16 farms reported no reduction. Forty-seven farms reported an increased acreage and 26 reported no increase due to the use of tractors. The 2-plow machine was found to be the most common. An average day's work of 10 hours for this size was 5 acres. About the same amounts of gasoline and kerosene were required to plow an acre, the average for all machines being 2.62 gal. of fuel per acre.

Data on maintenance and cost of operation are also included. It was found that the annual repair bills were high as compared to the East and Central West, but less than for those sections per day of service.

Hardening soft center steel plow shapes, G. W. RYNDERS (*Agr. Engin., 1 (1920), No. 1, pp. 8, 9, 17, 18, figs. 7*).—Data on processes for the heat treatment of soft center steel plows are given.

Climatic dairy barns, W. B. CLARKSON and C. S. WHITNAH (*Agr. Engin., 1 (1920), No. 2, pp. 23–26, figs. 5*).—A study is reported of the design of the ceiling, walls, windows, and doors of dairy barns, with particular reference to the various climatic conditions during the winter months.

A map is given showing the four so-called climatic zones. The first zone embraces the Provinces of Manitoba and Saskatchewan, parts of Alberta and Ontario, parts of the States of Minnesota and Montana, and the entire State of North Dakota. The second zone includes part of Pennsylvania, northern Missouri, Kansas, and Colorado, and the eastern part of Idaho. Zones 3 and 4 cover the southern part of the United States, and zone 4 also includes most of California and the western parts of Washington and Oregon. The boundary lines of the first two zones indicate territories where the temperature will drop as low as −30° F. The territory embraced in the third zone will experience a sustained low temperature between 0 and 10°. The northern portion of the fourth zone, especially on the western side, often experiences a temperature of zero or below.

The studies showed that in the first zone a temperature of from 35 to 40° in the stock room, where all other sanitary conditions are good, is comfortable for the herd. In the second zone a temperature as low as from 40 to 45° will be practicable, while in the third zone the barn temperature may be maintained at 50°. It is concluded that the barn temperature should never go below 33°.

Tests of temperature conditions in a number of dairy barns showed that the amount of heat given off by a herd of cattle is very nearly constant for cattle of a given size in a given climate. A ventilating system was found to make the most efficient use of the heat given off by the cattle by drawing the foul air from near the floor. The foul-air flue should therefore be of sufficient area to ventilate the barn properly.

It is stated that the barn should be so constructed that the heat loss through the walls will be small enough to leave the heat required for proper ventilation. Barn walls in the first zone should have a coefficient of heat loss not greater than 16 B. t. u. per hour per degree difference in temperature. Detailed drawings of barn-wall construction recommended for the four zones are given.

Carbon dioxid content of barn air, M. F. HENDRY and A. JOHNSON (*Jour. Agr. Research [U. S.], 20 (1920), No. 6, pp. 405–408*).—Determinations of the carbon dioxid content of the air in the dairy barn at the New Hampshire Experiment Station are reported by the authors, who are connected with the Carnegie Nutrition Laboratory.

Samples were taken at regular intervals during the day and night at 15 different locations at the front and rear of the animals. The carbon dioxid percentages found varied from 0.228 to 0.089. It is noted in this connection

that the percentages found by the Committee on Farm Building Ventilation of the American Society of Agricultural Engineers from studies of five barns were as high as 1.231, but for the most part were not higher than from 0.2 to 0.3.

Silo stave business expands, W. G. Kaiser (*Concrete [Detroit], 18 (1921), No. 1, pp. 45, 46, figs. 4*).—General information on the concrete stave silo business is given, together with the results of tests of a number of staves obtained from seven different manufacturers. These included transverse, compression, and absorption tests.

It was found that power tamped concrete staves are about 10 per cent stronger than hand-tamped staves, and steam cured staves are about 11 per cent stronger than air cured staves. The compression tests made on blocks cut from the staves showed strengths varying from 2,340 to 3,530 lbs. per square inch. The percentage of absorption varied on the average from 6.2 to 7.8. The transverse breaking load varied from 1,410 to 1,790 lbs. when applied at the center of the span.

Building plans for poultrymen and practical methods of poultry raising, edited by H. V. Tormohlen (*Waverly, Iowa: Poultry Breeders Pub. Co., 1920, pp. 128, figs. 71*).—A large amount of practical data and information on poultry house construction is given, which is derived from different sources.

The renovation and remodeling of cottages in country districts, A. Churton (*Jour. Roy. Sanit. Inst., 41 (1920), No. 2, pp. 137–144, fig. 1*).—General information on the remodeling of cottages in country districts in England is given, with a view to obtaining sanitation as well as convenience.

The modern cottage: Experiments in pisé at Amesbury, C. Williams-Ellis (*Jour. Min. Agr. [London], 27 (1920), No. 6, pp. 529–534, pls. 5*).—This report outlines an experiment made to compare four farm cottages of monolithic concrete, two of cobs, six of pisé de terre, or earth rammed between movable molds, two of timber, and two of timber and brickwork.

The purpose of this experiment was to determine the value of pisé de terre construction as compared with the other types. The available data show that so far the cost of pisé de terre construction is but little less than that of brickwork. The material used in the tests was approximately a 2 : 1 chalk and earth mixture. It was found that the essential qualities of a soil for pisé de terre work are a firm coherence of the constituent particles when rammed and dried, combined with an absence of excess shrinkage in the process of drying.

In general the percentage of water should vary between 7 and 14 per cent of the weight of the dried earth. A clay-gravel-sand mixture gave the best results with 15 per cent of water, while a chalk loam mixture gave the best results with 7 per cent of water. The shrinkage should not exceed from 2½ to 3 per cent, and can generally be kept less than 2 per cent when the water content is low.

An iron rammer with a smooth surface was found to be more satisfactory than a wood rammer. While winter construction was found to be possible, it was not economical. The details of different forms used are illustrated.

Improve the kitchen, B. S. Wood (*Ga. Col. Agr. Bul. 218 (1920), pp. 15, figs. 8*).—Brief popular information is given on the arrangement of farm kitchens for convenience and saving of time and labor.

Chimney and fireplace construction, R. S. Whiting (*Agr. Engin., 1 (1920), No. 2, pp. 28–30, figs. 6*).—Data on the construction of chimneys and fireplaces are given.

RURAL ECONOMICS AND SOCIOLOGY.

Should there be a department of sociology at the agricultural college? A. Maclaren (*Agr. Gaz. Canada, 7 (1920), No. 10, pp. 786, 787*).—The author

believes that if the agricultural college is to be an institution for training men for satisfactory country life and not simply to make a living on the farm, a department of sociology will have to be established at every agricultural college. The objects and lines of work of such a department are briefly stated.

Developments as to the price of agricultural products and of means of production during the last fifty years and their influence on agriculture and live-stock raising in Germany, E. J. GLÄSEL (*Landw. Jahrb., 50 (1917), No. 4, pp. 519–554*).—Some generalizations as to the effect of changes in prices received for agricultural products and expenditures for fertilizers, machinery, and wages as determining factors in the intensity of the agricultural business introduce the presentation of statistical material and studies of index numbers for prices and yields.

The average price for the decade 1861–1870 is taken as a base, and the changes which had occurred up to and including 1912 are shown. Prices of potatoes show an increase of 122 per cent. milk 100 per cent, and beef 98 per cent. Other varying increases are indicated. Wheat is shown to have remained about stationary in price and wool to have fallen in price 29 per cent. Index numbers for prices of commercial fertilizers and tools and machinery of various kinds indicate decreases of from 21 to 64 per cent. Agricultural and other wages show striking rises since about 1850. Men's wages per day in Saxony, for example, had increased about 200 per cent between 1862 and 1906.

Tables showing the buying power of certain products in terms of fertilizer, feeds, labor, and tools are worked out. All these data are then analyzed to account for the enormously increased importation and use of these means of production, changes in amounts and kinds of crops and live stock produced, and changes in the proportion of land devoted to different crops. A decrease is indicated of 52.3 per cent in the total area of pasture and grazing land. The growing of sugar and fodder beets, potatoes, and wheat is shown to have increased, that of sugar beets by 174 per cent, due to their high factory price combined with the feeding value of tops and pulp. The potato acreage has developed as a result of high prices and the fact that the cheapening of commercial fertilizers and their increased use brings into cultivation lighter land, demanding less labor, but which when properly treated grows potatoes successfully. This increase in turn is said to be one of the factors favoring increased swine raising and the use of pork.

Both crop production and live-stock raising are shown to have allowed German farmers as a whole increased net returns, owing to higher prices received and the fact that the growing cheapness of fertilizers and machinery overbalanced higher wages.

The farmer and foreign markets, E. G. MONTGOMERY (*Wallaces' Farmer, 45 (1920), No. 52, p. 2830*).—This article briefly outlines the importance of western Europe as the great world market, and urges the need of an agency to collect information in regard to supplies in foreign surplus countries and foreign consumption and buying power. An interpreting agency for the farmers, making available current information gained, is suggested.

Farm management investigations, A. LEITCH (*Agr. Gaz. Canada, 7 (1920), No. 12, pp. 963–965*).—This report tells of the establishment of the department of farm economics at the Ontario Agricultural College, the purposes of which is to conduct investigations into farming business and cost of production of farm products and to offer courses in the business of farming on the basis of investigational work conducted. Continuation of surveys previously noted (E. S. R., 42, p. 688; 44, p. 190) is planned. Other investigations in the apple-growing industry in Durham County and the fruit district in the Niagara Peninsula

are outlined, together with programs of detailed farm cost accounting and of determining the cost of producing milk on 100 York County milk-shipping farms.

Putting the farm on a business basis, W. F. Handschin (*Hoard's Dairyman, 60 (1920), No. 24, pp. 1033–1035, figs. 4*).—Data from a number of prewar studies of factors influencing profits are summarized to indicate the requirements of successful dairy farming. Briefly, these are said to be a business large enough to represent an economic unit for the region and type of farming carried on, good crops, good live stock well taken care of, and diversity in crops and live stock to insure the best use of man and horse labor.

Agriculture as a business, L. Smith-Gordon (*Better Business, 6 (1920), No. 1, pp. 28–47*).—This paper sets forth the advantages to agriculture of the application of six large-scale factory assets, the power to buy raw materials in large quantities and at the most favorable time, to obtain favorable rates and facilities in transportation, to advertise and offer standardized products to the public, to shift from one branch of manufacturing to another in accordance with the demands of the market, to utilize fully every unit of machine work, and to use reserved profits in employing skilled advice and modern improvements.

Education in the elementary business principles of specialization, standardization, efficiency in details, preparation of goods for market, buying, handling, and selling methods, and proper use of money is urged.

Essentials of successful cooperation, E. Davenport (*Hoard's Dairyman, 60 (1920), No. 23, pp. 1000, 1001, figs. 3*).—The author presents five principles which he considers necessary in building up successful cooperative organizations among farmers, namely, organizing an association to do what the individual can not do, selecting a capable and trustworthy manager and board of directors, supporting the association, sacrificing the right of the individual for the advantage of the group, and allowing expenditures for developing trade and an assured steady market.

Act creating farmers' cooperative societies, with forms governing incorporation (*Austin, Tex.: Dept. State, 1920, pp. 17*).—This gives the text of a law recently enacted by the Texas Legislature, providing for the private incorporation of persons engaged in agricultural pursuits into cooperative nonprofit corporations of purely local character, in general on the limited liability plan.

Report of the American Cotton Association's committee on cooperative marketing (*St. Mathews, S. C.: Amer. Cotton Assoc. Com. Coop. Marketing Rpt. 1920, pp. 80*).—This report discusses defects in the present system of cotton marketing and suggests cooperation as the remedy. Suggested practical means include uniform production by means of growing select varieties and maintaining a pure seed supply, the construction and operation of warehouses, and the organization and operation of cooperative marketing associations. Plans are given for organizing such groups. Various suggestive forms for by-laws and contracts are given in appendixes.

Northwest Wheat Growers' Association, H. Macpherson (*Wallace's Farmer, 45 (1920), No. 49, pp. 2717, 2720, figs. 2.*)—Certain outstanding features in the organization of this particular farmers' company and others on the same general plan are discussed from the point of view of their exceptional advantages. In this connection are noted especially three points, the long-time binding contract holding the allegiance of the farmers to the organization for a period of years, the warehousing corporation subsidiary to and controlled by the cooperative association, and the large-scale plan of control aimed at. It is said that this group is intended to control a minimum of 25 per cent of the entire Northwest wheat crop.

Marketing by federations, T. Macklin (*Wisconsin Sta. Bul. 322 (1920), pp. 24, figs. 6*).—The Wisconsin Cheese Producers' Federation, with headquarters at Plymouth, in Sheboygan County, Wis., assembles cheese from 120 factories in 13 counties of the State, distributing it in lots of 100,000 lbs. or more to 22 States of the United States. The experience of this federation in successfully marketing the product of its members is outlined in this bulletin. In 1919 about 6 per cent of the cheese production of the State was distributed by this organization. The point is made that relative operating costs have declined steadily in the six years of operation, while at the same time the organization has maintained high standards of product and gotten prices somewhat higher than those on the local market.

The text of the revised articles of incorporation of the federation is appended.

Cooperation: Historical development and its progress in Argentina, D. Bórea (*Rev. de Revistas [Buenos Aires], 3 (1920), No. 33, pp. 12–31*).—This article describes the history of various forms of cooperation in several countries, and notes in some detail two societies organized in Argentina in 1898 and 1904, respectively. Early efforts to study and encourage the cooperative movement and enact legislation protecting it are related.

Census returns are given to indicate 73 mutual agricultural cooperative societies operating in the country in 1914–15, 39 of which were mixed agricultural cooperatives whose objects were collective purchase, sale, or credit. One cooperative agricultural bank of the type of the People's Banks of Italy existed. Ten mutual insurance and credit societies, two cooperative fruit-growing, one wine-growing, and four irrigation organizations, five cooperatives in colonies of the Jewish colonization association, and eleven Catholic rural banks of the Raiffeisen type are noted. This number indicates only a slight increase over that for the two preceding years. A loss of 66,034 hectares (about 163,104 acres), or 4.72 per cent, in the total area insured in cooperative enterprises is noted for 1914–15.

The general indifference and backward development is attributed to the speculative character of agriculture and land settlement in Argentina, fraudulent promotion, lack of protection by law, and lack of leadership. Fundamental principles of success are outlined, and a model law is suggested.

Village trade unions in two centuries, E. Selley (*London: George Allen & Unwin, Ltd., 1919, pp. 183*).—The historical development of farm laborers' unions in Great Britain from 1833 to the passage of the Corn Production Act in 1917 is outlined, noting their instability and failure to improve the status of the farm worker until recent years and the establishment of the Agricultural Wages Board and district committees. In appendixes are found several tables taken from sources previously noted (E. S. R., 38, p. 192) and (E. S. R., 41, p. 193).

Colonization projects in Wisconsin, M. C. Calkins (*Survey, 45 (1921), No. 14, pp. 480–485, figs. 5*).—Details of operation of three types of private land settlement companies selling cut-over lands in Wisconsin to men with little or no capital are given in these pages.

Nebraska resources and industries, S. R. McKelvie and G. E. Condra (*Nebr. Univ., Nebr. Conserv. and Soil Survey Bul. 14 (1920), pp. 115, figs. 23*).—This report consists of signed articles by persons engaged in the study and development of the soil, mineral, water, wild life, and agricultural resources of Nebraska, as well as manufactures, transportation, communication, markets, and education in this State.

Agriculture and the State, G. Valenti (In *L'Italia Agricola e il suo Avvenire, I, Rome: R. Accad. Lincei, Comitato Sci. Aliment., 1919, pp. 1–26*).—It is urged that Government efforts for the promotion of Italian agriculture

should be so organized as to meet the peculiar requirements of the four distinct regions having special agricultural conditions. The agricultural conditions of the plains, mountains, and northern and southern parts of the country are said to be very different. The division among existing ministries of the agricultural investigation and aid by the State is urged, and it is suggested that the ministry of agriculture become the coordinating body.

Italian agriculture from the constitution to the outbreak of the European war, G. Valenti (In *L'Italia Agricola e il suo Avvenire, I, Rome: R. Accad. Lincei, Comitato Sci. Aliment., 1919, pp. III–CII*).—This paper is an introduction to the study of Italian agriculture, the proposed outline of which was noted (E. S. R., *40*, p. 891), and which is provided for by the Italian Federation of Agricultural Associations. It offers a brief note on general agricultural conditions in Italy and a study of available statistics of the cultivated area and yields, mainly of grains, in two periods, the first from the winning of independence (1831–1870), and the second (the period from 1871–1900), reviewing the present status of Italian agriculture. Official statistics of the ministries of agriculture are given for the production and trade in cereals and other crops in the various sections of the country. The author urges diversification and the subdivision of large landholdings.

In the appendix are given agricultural statistics for 16 subdivisions of Italy.

Agricultural statistics representing the Italian rural economy, G. Valenti (In *L'Italia Agricola e il suo Avvenire, I, Rome: R. Accad. Lincei, Comitato Sci. Aliment., 1919, pp. 67–98*).—Suggestions are made for the reorganization and improvement of the agricultural statistics, the census to include live stock and live-stock products hereafter.

Statistical data compiled and published by the Bureau of Crop Estimates, 1863–1920 (*U. S. Dept. Agr., Dept. Circ. 150 (1921), pp. 64*).—Part 1 of this circular presents a complete list of publications of the Bureau of Crop Estimates, with serial number, title, author's name, and year published.

In part 2 the subjects included in the reports and records are arranged alphabetically, showing the kinds of information available, dates, and page references to the *Monthly Crop Reporter*, or number of office records of unpublished material.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7 (1921), No. 1, pp. 8*).—The usual monthly estimates of acreage and production, brief articles, and tabulated data relating to stocks, condition, and value of important agricultural products are presented. A statement is given showing recent esimates of the cereal requirements and surplus for the crop year 1920–21 of grains for human and animal food in the United States, Canada, India, Australia, New Zealand, South America, and European countries, also a brief article reviewing foreign crop prospects on January 1, 1921, is included.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3 (1921), Nos. 5, pp. 65–80, fig. 1; 6, pp. 81–96, fig. 1*).—Abstracts of information on domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products, together with analyses of foreign market conditions, are given. These issues cover the period up to about February 5. Practically universal price declines and weak markets are recorded in each, the one exception being the slight advance in cotton futures during the week ended January 29. No. 5 offers a special article on world consumption and trade in cotton, indicating decreases in production and consumption during the past few years, and predicting an available supply July 31, 1921, considerably larger than in the record year 1914–15. Recommendations are made in No. 6 with regard to two standard cabbage grades.

Grain and flour statistics during the war, compiled by A. L. Russell (*New York: U. S. Grain Corporation, 1919, pp. 48; Sup., 1920, pp. 44*).—Statistics compiled from reports to the U. S. Grain Corporation in regard to the movement of different grains, stocks, and grind in the mills, milling costs, and sources of wheat supplies during the year 1917–18 are given. The supplement covers some statistics for 1917–18 and 1918–19, but mainly those for 1919–20 in regard to wheat and wheat flour only.

General abstracts showing the acreage under crops and the numbers and descriptions of live stock in each county and province, 1916, 1918, and 1919, J. Hooper (*Ireland Dept. Agr. and Tech. Instr., Agr. Statis., 1919, pp. 38*).—This report adds data for 1919 to summaries previously noted (E. S. R., 41, p. 594).

Acreage and live stock returns of Scotland with a summary for the United Kingdom, J. M. Ramsay (*Agr. Statis. Scot., 8 (1919), No. 1, pp. 55*).—This statistical report and summary continues information previously noted (E. S. R., 42, p. 896).

Prices and supplies of grain, live stock, and other agricultural produce in Scotland, J. M. Ramsay (*Agr. Statis. Scot., 7 (1918), No. 3, pp. 83–113*).—This report continues information for 1918 previously noted (E. S. R., 44, p. 896).

AGRICULTURAL EDUCATION.

Acts of the higher council for the improvement of agricultural education, I (*Actes du Conseil Supérieur de Perfectionnement de l'Enseignement Agricole, I. Brussels: Min. Agr., 1920, pp. 67*).—This pamphlet includes the text of the royal order of March 31, 1919, creating the Higher Council for the Improvement of Agricultural and Horticultural Education; the organization of the council; proceedings of the general and section meetings of the council held in 1919; the text of the law of November 15, 1919, revising the law of April 4, 1890, relative to agricultural education in Belgium (E. S. R., 43, p. 295); and lists, in French and Flemish, of publications for agricultural libraries for farmers, for farm women's clubs and agricultural home economics schools, and for agricultural schools for boys.

The council comprises five commissions, viz, higher agricultural and horticultural education, secondary agricultural education, popular agricultural education, secondary and popular horticultural education, and agricultural home economics education. The union of all the commissions in recommendations as to legislation is contemplated.

It was concluded that the courses in agriculture in secondary schools should remain optional but should be definitely organized in concord with the instruction in the natural sciences, of which they are the application. They should comprise a minimum of 40 lessons, of which at least 10 should be excursions. The instructor in agriculture who is not a college graduate should have passed a special examination in agriculture, and reciprocally, the agricultural college graduate an examination in pedagogics. In each school one-half of the lessons should be given by an instructor designated by the Ministry of the Sciences and Arts, and the other half by an incumbent of the Ministry of Agriculture. Means for the popularization of agricultural instruction are recommended.

It was decided that the courses of the first three grades of the elementary rural school, in which an agricultural atmosphere should prevail, should serve to give children the elements of knowledge indispensable to all in the present state of society, with an application relating to the interests and agricultural

needs of the rural population. In the fourth grade one-half of the time should be devoted to the completion of general culture and the other half to the subjects having practical applications as provided in the school law.

In the reform of normal instruction it is to be insisted upon that the normal studies be followed by a year of special agricultural or home economics instruction in an appropriate farm school. Attention is called to the need for including in the last year of the normal school course in rural communities, temporary courses in agronomy, zootechny, etc., with a sufficient number of lessons in elementary drawing and rural construction. The departments of sciences and arts and of agriculture intend to organize, for rural teachers, temporary courses in agriculture and agricultural home economics on the one hand, and in theory and practice on the other, leading to an examination for special certificates of efficiency.

The agricultural home economics section examined an elaborate project relative to a course of improvement to be organized in Brussels for teachers of agricultural home economics. It was decided to submit to the ministry of agriculture a time project for a pedagogical week for teachers of agricultural home economics instruction. The conclusions adopted with reference to a report on the organization of a higher normal school of agricultural home economics, and the organization of a service of agricultural home economics advisers, are included.

The State system of agricultural teaching in France, G. WERY (*World Agr., 1 (1920), No. 2, pp. 22, 23, fig. 1*).—This is a comprehensive account, by the director of the National Institute of Agronomy in Paris, of the organization of the State system of agricultural teaching in France.

Nineteenth annual general report of the Department of Agriculture and Technical Instruction for Ireland, 1918–19 (*Ireland Dept. Agr. and Tech. Instr., Ann. Gen. Rpt., 19 (1918–19), pp. VI+404*).—This is the usual annual report of the department's administration, funds, and details of operations during the year 1918–19, including agricultural and technical instruction.

Report of the department of agriculture of Sweden for 1917 (*K. Lantbr. Styr. [Sweden] Underdåniga Ber. 1917, pp. [8]+468+XII*).—This is the annual report on the activities of the various agencies for the promotion of agriculture under the control of the department of agriculture of Sweden, including agricultural, horticultural, dairy, and housekeeping schools, dairy, chemical, and seed control stations, the extension service, agricultural associations, etc.

Report on agricultural and small farming schools for 1917–18, I. NESHEIM (*[Norway Landbruks Dept.] Ber. Landbruks Smabruksskol., 1917–18, pp. [2]+VI+L1–L295*).—This is a detailed report on the faculty, students, equipment, instruction, farm work, and receipts and expenditures of the agricultural, housekeeping, and small-scale farming schools of Norway, and on the work of the three itinerant agricultural instructors.

Twenty-five years of the Reifensteiner Association of Farm and Home Management Schools for Rural Women (*Land und Frau, 4 (1920), No. 40, pp. 317, 318, figs. 2*).—This is a brief account of the work of this association in the establishment of home and farm management schools for women in rural districts, begun 25 years ago.

Reorganization of rural public, continuation, and special instruction (*Ztschr. Deut. Landw. Rats, 18 (1920), No. 5, pp. 133–139*).—Outlines are given of two projects for the reorganization of rural instruction of all grades in Germany, including special agricultural schools, prepared by Dr. Seedorf and Government Councilor Ströebel, respectively, which were approved by the general assembly of the German Agricultural Council at its meeting on April 20 and 21, 1920

[Agricultural instruction in the Province of Alberta] (*Alberta Dept. Agr. Ann. Rpt., 1919, pp. 44–71, 77–89, figs. 2*).—Included in this annual review of the work of the Department of Agriculture of the Province of Alberta, are reports on the instruction and experimental work of the college of agiculture at Edmonton and the schools of agriculture at Claresholm, Olds, and Vermilion, and the reports of the superintendents of fairs and institutes and of women's institutes.

Summer schools in agriculture (*Agr. Gaz. Canada, 7 (1920), No. 10, pp. 799–807, figs. 6*).—Reports on the work of the 1920 summer schools in agriculture for rural school teachers and inspectors, held in Nova Scotia, New Brunswick, Ontario, Saskatchewan, and British Columbia.

Tropical agricultural college, F. Watts (*Fed. Malay States Dept. Agr. Bul. 8 (1920), No. 1, pp. 18–28*).—This is a discussion, by the imperial commissioner of agriculture for the West Indies, of the report and recommendations of the committee appointed by the Imperial Government of Great Britain to consider the desirability of establishing a tropical agricultural college in the British West Indies, and to advise generally on the subject.

Forest research institute and college, Dehra Dun (*Forest Research Inst., Dehra Dun, Calendar, 1919, pp. [II]+112*).—This is the triennial announcement of the ranger course given at the Forest College, and of the provincial service course offered at the Forest Research Institute, each extending through 24 months, together with syllabi. A brief statement of the organization of the provincial and subordinate forest services of India is included.

Plans for the administration of the Federal act for vocational education, 1920–21 (*[Trenton]: N. J. Bd. Ed. [1920], pp. 94*).—This is an outline of the plans for the organization, administration, and supervision of vocational education under the Smith-Hughes Act in New Jersey for 1920–21.

The agricultural teacher-training course will extend through 4 years, or a total of 150 hours, of which 40 per cent will be devoted to agricultural, 31.3 per cent to scientific and mathematical, 18.6 per cent to humanistic and military science, and 10 per cent to professional subjects. Teachers in training will be assigned to the various vocational agricultural schools for observation and practice teaching, serving as assistants to the agricultural teachers for 3 hours a week throughout the second term of the senior year. The home economics teacher-training course extends through 4 years, or 146 term hours.

Vocational agricultural schools will be organized either as departments in the high schools or as county vocational agricultural schools, each offering long and short courses. Typical 4-year agricultural and home economics teacher-training and high school and county school vocational agricultural and vocational home economics, curricula are outlined.

Plans for vocational education, 1920–21 (*Helena, Mont.: Dept. Pub. Instr., 1920, pp. 39*).—This is a statement of the plans for the administration and operation of vocational education in Montana for 1920–21.

Plans for vocational education in Nebraska (*Nebr. Bd. Vocat. Ed. Bul. 4 [1920], pp. 38*).—A detailed statement of the plans for vocational education in Nebraska for 1920–21, including outlines of courses of study.

Vocational education in home economics: Part-time schools and classes, A. S. Baylor (*Jour. Home Econ., 12 (1920), No. 11, pp. 473–481*).—The author defines education in vocational home economics from the viewpoints of (1) the interpretation of the Smith-Hughes law, (2) the purpose of the work as expressed in the term "vocational," viz, training for the vocation of home-making, (3) its method of instruction, i. e., job analysis and the home project, and (4) the groups of pupils for whom it is intended. The three types of part-time classes or schools are discussed with reference to time devoted to subjects,

girls for whom they are intended, the content and organization of the home-making courses, and the teacher. The author states that compulsory State legislation, which is deemed almost a necessity for establishing successful part-time work, has increased from 2 States in 1917 to 19 in 1920. The number of part-time schools in homemaking reimbursed from Federal funds has increased from 27, with an enrollment of 4,278 pupils and 74 teachers in 1918–19, to 325 such schools with an attendance of 10,913 pupils and 313 teachers.

Status and results of home demonstration work, Northern and Western States, 1919, F. E. WARD (*U. S. Dept. Agr., Dept. Circ. 141* (*1921*), *pp. 25, figs. 10*).—This is a report on the early development and status in 1919 of home demonstration work in the Northern and Western States, together with a summarized statement of results in the home, garden, poultry yard, school, and community.

Vocational agriculture in the high school, W. F. STEWART (*Ohio Bd. Ed. Vocat. Agr. Bul. 3* (*1920*), *pp. 35, figs. 15*).—This bulletin contains information concerning the actual working conditions and instruction of the Ohio plan for vocational agricultural education, including a suggested outline of a four-year course in vocational agriculture, a winter short course, community work, and suggested lists of books for the agricultural reference library, agricultural apparatus, and farm-shop equipment.

Community farm surveys, R. B. SMITH (*Little Rock, Ark.: State Bd. Control Vocat. Ed.* [*1920*], *pp.* [*8*]).—Suggestions are offered for the use of the instructor of vocational agriculture in making a community farm survey as a basis for his school and community work.

Seventy-two exercises in soils and crops, H. H. HOLTZCLAW (*Little Rock, Ark.: State Bd. Control Vocat. Ed.* [*1920*], *pp. 36*).—Seventy-two exercises in soils and crops are outlined for the first year's work in vocational agriculture in Arkansas schools. Ten arithmetic problems are included.

Notes on the conference on elementary soil teaching, held at Lexington, Ky., June, 1920, P. E. KARRAKER (*Jour. Amer. Soc. Agron., 12* (*1920*), *No. 6–7, pp. 211–214; Soil Sci., 10* (*1920*), *No. 3, p. 247*).—At this conference (E. S. R., 43, p. 299) a recommendation was adopted that the first or elementary soils work in colleges should be given in a uniform general course, known as the "principles of soil management," dealing largely with the scientific principles underlying the successful management of soils with such practical application as good teaching and local conditions demand. This course, carrying approximately five semester hours' credit, should be required of all agricultural students in the sophomore year when practicable. The subject matter should be presented in well correlated lecture, recitation, and laboratory work, at least three-fifths of the time being devoted to the lectures and recitations. It was found desirable that a standard textbook be used. A suggested general outline of laboratory exercises, covering one semester hour's time, is given in which the common stock exercises as well as exercises involving mainly quantitative work are largely omitted if the laboratory work is confined to one credit hour a week.

An outline of an undergraduate course in grain grading, J. B. WENTZ (*Jour. Amer. Soc. Agron., 12* (*1920*), *No. 6–7, pp. 198–204, pl. 1*).—An outline is given of a course in grain grading according to the Federal standards, including two lectures and one 3-hour laboratory period a week, as offered in the winter semester at the University of Maryland. Direction sheets for grading are included.

[How teachers may use certain Farmers' Bulletins], F. A. MERRILL (*U. S. Dept. Agr., Dept. Circs. 156* (*1921*), *pp. 6; 157, pp. 8; 158, pp. 8; 159, pp. 7, fig. 1*).—These circulars offer suggestions to teachers, especially in rural ele-

mentary schools, on the method of using the subject matter contained in Farmers' Bulletins Nos. 1175, Better Seed Corn (E. S. R., 44, p. 230); 1148, Cowpeas: Culture and Varieties (E. S. R., 44, p. 36); 1125, Forage for the Cotton Belt (E. S. R., 43, p. 638); and 1121, Factors that Make for Success in Farming in the South (E. S. R., 44, p. 89).

How teachers may use Farmers' Bulletin 1087: Beautifying the farmstead, C. H. SCHOPMEYER (*U. S. Dept. Agr., Dept. Circ. 155 (1921), pp. 6*).—Suggestions are offered to teachers, especially in rural elementary schools, on the method of using the information contained in Farmers' Bulletin 1087 (E. S. R., 42, p. 838).

Some studies of children's interests in science materials, C. W. FINLEY (*School Sci. and Math., 21 (1921), No. 1, pp. 1–24, figs. 17*).—This is a report on the methods of experimental procedure and results of studies conducted in the schools of six cities and in seven rural schools to obtain data giving evidence regarding the interest of children in grades one to eight, inclusive, in (1) animals and (2) plants, animals, and physical phenomena.

The continuation and professional training of farmers' daughters, HINRICHS (*Land und Frau, 4 (1920), No. 39, pp. 309, 310, figs. 2*).—A description is given of a plan of instruction in agriculture and home economics for girls, conducted from the middle of April to August 14 at an agricultural winter school for boys.

Suggestions for organization and conduct of classes of home economics education in evening and part-time schools in Ohio, T. E. KAUFFMAN (*Ohio Bd. Ed. Vocat. Home Econ. Bul. 1 (1920), pp. 28*).—These suggestions include outlines of unit courses in feeding and clothing the family, the health of the family, including a study of sanitation and home nursing, care and welfare of children, and planning, furnishing, and managing the home.

Home economics courses of study for junior high schools (*U. S. Bur. Ed., Home Econ. Circ. 9 (1920), pp. 14*).—It is stated that the consensus of opinion is that in the first four years of the elementary school both boys and girls should be given progressive instruction in industrial arts, but that beginning with the fifth grade the work for boys and girls should diverge. Courses are briefly outlined for girls in the fifth grade, consisting of simple food preparation and housewifery, and in the sixth grade, of sewing, food preparation, and review of housewifery. Detailed suggestive outlines are given for required work in home economics, consisting of school and home projects, investigation reports, and recitations, in the seventh, eighth, and ninth grades, together with motives and time allotment for school systems having the 6–3–3 plan and the 8–4 plan. The subjects include the care, selection, and making of clothing; meal preparation and service, food preservation, marketing, food study, and food accounts; home nursing and care of children; and a survey course giving the student a well-rounded conception of the many studies contributing to worthy home membership.

MISCELLANEOUS.

Annual Report of South Dakota Station, 1920 (*South Dakota Sta. Rpt. 1920, pp. 31*).—This contains a report by the director on the organization, work, and publications of the station, a financial statement for the fiscal year ended June 30, 1920, and departmental reports. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1921), No. 10, pp. 145–163, figs. 9*).—In addition to articles abstracted elsewhere in this issue, this number contains a brief article entitled The Dairyman and Falling Prices, by H. E. McNatt.

NOTES.

California University.—Funds provided by the proceeds of the Horgan estate, recently bequeathed to the university as previously noted (E. S. R., 43, p. 599) have enabled the college of agriculture to offer three assistantships for research in agriculture. These positions are to carry a compensation of $600 per annum, and the work is to be done at Davis. Candidates must be registrants for advanced degrees, and aside from such graduate work will devote full time to the problem assigned for investigation.

Walter L. Howard, in charge of the Deciduous Fruit Station at Mountain View, has been granted a year's leave of absence to make a study in France, Italy, Spain, and England of root stocks for deciduous fruits.

Delaware University.—By act of the legislature the name of Delaware College has been changed to the University of Delaware.

Louisiana Stations.—R. W. Axt has been appointed assistant horticulturist at the State Station.

Massachusetts College.—The first student conference of the International Association for Agricultural Missions was held at the college April 8 to 10, with an attendance of over 100 delegates, representing twenty colleges, theological schools, and other institutions of learning, mainly from New England, New York, and Pennsylvania. The speakers included numerous missionaries from all over the world, representatives from mission boards, and others. Various phases of the subject were considered, with special stress on the growing importance of agricultural missionary work and the necessity of adequate training for workers in this field. In connection with the conference, the part played by President Clark, Professor Brooks, and other members of the college faculty in the founding of the first agricultural college in Japan was referred to, as well as the recent establishment of a special 2-year course for the training of agricultural missionaries.

Some idea of the growing importance of agricultural missions is afforded by the report that no fewer than 231 mission stations now operate farms. Some of these are of considerable size, the Presbyterians owning one farm of 10,000 acres and another of 12,000 acres in Brazil. Likewise the Methodists have one farm of 2,000 acres in Africa and have just acquired another of 12,000 acres, as well as a farm of 400 acres in France to demonstrate American agricultural machinery and stock raising methods.

A somewhat novel seminar was held at the college from April 25 to May 6, in charge of Dr. William A. Orton of the Bureau of Plant Industry, U. S. Department of Agriculture, and participated in by members of the horticultural staff, teachers, research men, and extension specialists. The general topic of the lectures was The Interrelations of Horticulture and Pathology. The lectures and discussions covered a wide range, including such topics as transit and market spoilage of horticultural products, horticultural aspects of the control of disease by diet, the biological basis of plant quarantine, U. S. plant quarantines and their effects on American horticulture, plant problems of the Tropics, disease resistance in plants, inspection and certification as an aid to seed and plant improvement, and the organization and upbuilding of American horticulture.

Montana College and Station.—P. V. Cardon, head of the department of agronomy of the college and agronomist of the station, has resigned effective July 1 to become head of the School of Agriculture at Cedar City, Utah.

New Hampshire Station.—The first State appropriation for the station has just been made by the legislature, $5,000 being provided for the year 1921–22 and $7,000 for the following year.

North Carolina College.—The first course in cotton grading for farmers and others was held at the college from January 20 to February 3. The course included four hours' practice work daily in cotton grading, as well as lectures on varieties, methods of improving yield by seed selection, and the proper fertilization of cotton grown in different sections.

Ohio State University.—A Plant Institute has been organized in the College of Agriculture to promote research. A series of plats have been laid out for continuous experiments, and it is planned to develop in connection with these certain features of cooperative work involving a number of different departments included in the institute.

Oklahoma College.—President J. W. Cantwell resigned about April 1 and will be succeeded at the end of the college year by Dr. James Burnett Eskridge, president of the Southwestern State Normal School at Weatherford, Okla., for the past six years.

Pennsylvania College.—R. A. Dutcher, associate professor of agricultural biochemistry and head of the animal nutrition section of the Minnesota University and Station, has been appointed professor of chemical agriculture beginning July 1. Other appointments include P. L. Sanford as assistant professor of poultry husbandry extension, beginning April 1; and Dr. H. E. Thomas as assistant professor of botany, beginning July 1.

Tennessee University.—The legislature has restored the half mill tax for the benefit of the university, this supplanting a sliding scale tax rate adopted in 1919. The exact amount of funds available are contingent upon the property assessment, but beginning with July, 1922, financial conditions are expected to be considerably improved.

A special feature of the 1921 commencement is to be the dedication of the two newly completed buildings. One of these is Ayres Hall, the imposing liberal arts building named in honor of former President Brown Ayres. This building is to be dedicated June 7, with an address by Dr. P. P. Claxton, U. S. Commissioner of Education. The other building is the three-story agricultural building, which is to be dedicated June 6 with an address by President W. O. Thompson of Ohio State University and a series of conferences on agricultural, home, and social welfare, the press, the professions, banking, industry, and civil administration for the formulation of a constructive educational program for the State.

Wisconsin University and Station.—In order to facilitate the work connected with "driving back the brush line" in the cut-over regions, the college of agriculture has appointed A. C. Fiedler as extension specialist in land clearing. Several county clearing associations have already been organized, and indications are that a larger acreage than ever before will be cleared of stumps during 1921.

D. S. Bullock, assistant professor of animal husbandry, has resigned to become field representative of the Bureau of Markets, U. S. Department of Agriculture, in South America. J. H. Kolb has been appointed instructor in agricultural economics and assistant agricultural economist; H. H. Sommer, assistant professor of dairy husbandry; and L. C. Thompson, instructor in dairy husbandry.

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EXPERIMENT STATION RECORD.

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The effect on the experiment stations of the type of organization which is being developed at the agricultural colleges is a matter deserving consideration. There are some indications that unless care is observed it may react unfavorably on the progress of agricultural research and on the attractiveness of positions in that field. While this is unintentional, experience has already shown that if carried out too rigidly such an organization is in danger of subordinating the station forces and unduly restricting their freedom and their outlook. This is a condition which every institution will wish to guard against, since research needs to be stimulated by an atmosphere of freedom, the development of individual initiative, and the opportunity for growth.

There is a tendency at present to lay much stress on organization, to develop systems and standardize plans, and to extend these throughout the institution. It is usually expressed in the bringing together of all activities in a given field to form large subject matter departments—the grouping of all the forces for teaching, research, and extension in such departments, under heads clothed with considerable administrative responsibility, who represent the departments in the college organization. The strength and the activities of such individual departments are largely in the hands of their respective heads, and in practice progress depends upon their breadth of training, their interests, and their attitude toward the different types of work.

Within these departments are often subdivisions, each with its subhead, as in the case of the department of animal husbandry with its divisions for beef cattle, swine, sheep, poultry, etc. And under these heads and subheads are the specialists and experts engaged in research, teaching, extension, etc. Sometimes these heads and subheads are themselves ranked as the leading experts, with the other members as associates or assistants. The latter may therefore be quite remote from those in authority and far down the line in seniority, especially in case of large departments.

The grouping of the personnel by subjects has much to commend it. It insures close association and intercourse between the workers in different divisions of the same group, and it provides for an orderly

management of the department as a whole. It serves to coordinate the work and the teaching in that subject, and enables it to be handled as a unit as far as may be desirable. It is looked upon as a simplification of organization.

But there is a tendency to magnify these administrative positions, to build large departments, to enlarge the authority and responsibilities, and to exercise more than general control over the personnel as well as the direction of the department as a whole. The organization thus becomes a rigid one, with little elasticity or latitude in case of individuals, and with the research men merged with the others irrespective of the grade of their work. Seniority becomes fixed, appointments are made largely in accordance with it, and advancement may depend on position in the group rather than on rating in the station force. Such consequences are, of course, unfavorable and affect the station in no small degree.

In a large institution a close organization by departments may place the experts in a relatively subordinate position, not wholly consistent with their advanced training or the class of work they are engaged upon. In a small institution, on the other hand, it makes the contrasts even sharper. It frequently has the effect of elevating one man above another, more often, perhaps, the college man over the one who is primarily an investigator, where the positions have heretofore been coordinate, because the former is more likely to be suited to general administration of a department. Not only the salary of the station worker is affected by this, but his position in the college and his prospects.

In the strictly agricultural branches department heads are often not primarily investigators or especially interested in that line, and they are not selected because of peculiar ability to lead or stimulate that type of activity. They are quite as likely to be chosen because of their fitness to meet the special needs of the college as a whole—to build up strong departments, to make the teaching popular and effective, to develop interest in their subjects in the State, and to make a favorable impression when they go before the public. In fact, the work and the tastes of an outstanding investigator are quite likely not to fit him for the manifold duties of a department head.

The effect of this type of organization carried out rigidly is to emphasize administration, and to lead to the feeling that the outlook and the rewards lie in that field. Placing it above creative ability in research implies a lack of appreciation of the latter as a primary function of an institution of learning, a failure to accord it and its votaries the honor and reward they might expect. It may be misinterpreted to reflect a popular feeling that administration calls for a

special type of ability, that teaching is the essential function, while research is more or less ornamental. The effect is to put a premium on a grade of ability which is less rare and less exacting than that for research, and one which is frequently not present in the best type of investigator.

A case in point which may be cited is that of a relatively small institution in which the station work in animal husbandry has of late been separate from that of the college, with its own specialist, and has involved two main lines of inquiry, each calling for special equipment and stock. Both of these lines are quite technical in character. They have made important progress, and the conditions surrounding them have been well-nigh ideal from the standpoint of investigation. The grade of work has been highly creditable to the station and to the college with which it was connected. Nothing comparable with it was carried on prior to the time when the separation was made.

Recently, however, a plan has been developed by the college authorities for combining teaching and research in that department under a single administrative head, with the result that the station expert will no longer be coordinate but subordinate to his colleague who becomes head of the department. His position is made less attractive from the standpoint of rank and general outlook, and the continuance of highly important lines of research is endangered. The change results from the carrying out of an organization ideal, without due consideration of its effects.

To sacrifice the interests of the experiment station to such an ideal may be to overlook the greater interest in the pursuit of a scheme which is impracticable for the place and time. It may be a case of rigidly enforcing a plan which greater consideration would allow exceptions to in specific cases. The advantage may not offset the evident disadvantage.

It is desirable to free research men from large administrative duties as much as possible, in the same way that it is to relieve them of various interruptions and obligations in the college. But there should be no suggestion that position and opportunity lie in that field and not in research. The opportunity in research needs rather to be emphasized, and there is no reason why it may not be. It needs more effort at present to attract and hold men in that line than in any other.

Equally, the college should be able to utilize a man's services in the channel to which he is best suited. But in doing so it ought to be able to extend opportunity which will encourage the individual to his best efforts and to growth. To cut itself off from doing this by an inelastic plan of organization is to work to its own ultimate disadvantage.

Manifestly, every consideration suggests that the station work and the station personnel should stand in no secondary position in the institution. Unless the scheme of departmental organization takes account of the high qualifications of the station specialist and leaves the way open for the recognition of rank and ability, it will deprive station positions of much of their attractiveness and men will be discouraged from preparing themselves for that field. It will further hamper the widely advocated plan of differentiation of duties, with the provision of specialists to give themselves mainly or wholly to research.

The organization by departments, with the chief administrative officer standing at the head of the station work, as is often the case, fills the first place in that field, whether or not the department head is very active in research. It thus has a tendency to subordinate all the other workers in that line, placing distinct limits on the outlook and the possibility of independence in research. Carried out rigidly, it does not make for the development of a strong self-reliant group of investigators. It contributes to the lack of permanence, for under it the only prospect for growth in position is change to another institution.

Furthermore, the segregation of the work on the basis of the kind of animal, rather than the problem, tends to encourage the ordinary conventional feeding experiments, rather than fundamental nutrition studies which apply to animals without regard to class. Such a grouping of workers and equipment may also fail to make provision for special types of workers and special facilities which are needed by the station.

It is by no means necessary that the station facilities should be merged with those of the college as a whole. There is no logical reason for this now that research has reached a point where it requires special equipment, more refined conditions, and special care in conduct, as compared with the other farm operations of the institution. On the other hand, the station very often needs its own equipment in the laboratory, field, greenhouse, and stable, and it needs forces to work under its immediate direction.

Research of the advanced type such as is now needed will call for a type of more severely trained and selected investigators than much of the work of the past. It will require the retaining of the best and the encouragement of others properly qualified, through provisions which are attractive and promise reward in position and advancement as well as in salary. To quote from the director of the Rothamsted Station, "no research station could be run successfully on the principal of the survival of the unfit; the best men must be retained;" and as Sir Daniel Hall has declared, "it is no good entrusting so complex and difficult a matter as investigation of an

agricultural character to any but the best minds. To attract these and to stimulate and hold them as they develop in ability requires emphasis on the opportunity and the prospects in an agricultural research career."

The forming of departmental groups need not necessarily imply that the direction and the prospect of the research workers is fixed by it, or that their rank is determined by that affiliation. As far as they are charged exclusively with station duties they are responsible to the station organization and to the director. In that connection they will naturally be graded on the character of their work, its individuality, and the degree of independence with which it is conducted. For administrative purposes the station is the stronger bond, and it may properly be the stronger organization in most respects. In some of the large universities, for example, the departmental organization is a rather loose one, the head being in the nature of a chairmanship which may rotate among the members of the department.

The necessity is obvious of developing a larger proportion of the station force with freedom from burdensome college duties. There is no reason why this should not be the case with some of the leading experts on the staff. But it will call for deserved recognition in the college organization. It should be quite as possible for the person engaged exclusively in station work to attain the rank of full professor as one who teaches. Indeed, in some universities the research professorship is placed at the apex of the organization, in recognition of the paramount position of research.

The man of research has invested his life and his talents in research. He does not expect large pecuniary dividends, but reward which is measured to some extent in other terms. Reputation which is earned and recognition which is freely accorded are two important expressions of this reward. He has no desire to be pampered and no expectation that he will be given special privileges, but he wishes to be understood, to feel that his work and position are being considered in their rightful relations to the other functions of the institution. He desires to have large things expected of him—this puts him on his mettle; and he asks only opportunity to rise by his own efforts and in proportion to his merits. The measure of his success and the promise it holds out for a satisfying career will have a large influence on those who may be looking toward it.

It has been said that genius is the capacity for taking infinite pains. While this will not be accepted as a complete definition, it has reference to a quality which is of more significance than is sometimes accorded it, a quality which goes a long way toward making possible

the product which is hailed as one of genius. It will be recognized as a peculiarly essential attribute in research.

In accepting a discovery the general public fails to realize the processes by which it has been accomplished or what it has entailed. This frequently leads to the inference that it represents a particularly bold stroke of originality, quite unaccounted for by the ordinary processes; that it is due to a peculiar power which enables discoveries to be evolved spontaneously, as it were, out of the inner consciousness or through divination, or at least by some sort of short-cut process. Such a view is likely to be taken also by those not thoroughly familiar with the methods by which knowledge is advanced, and even within the ranks of investigators there is sometimes a suggestion that dependence does not rest wholly on disclosing the bare facts.

While recognizing the existence of extraordinary mental capacity and the exhibition of uncommon native power in research, it is well understood that brilliant advances usually trace back to a long line of painstaking inquiry, either by the author himself or others in that field. Beyond certain brilliance of conception and imagination, the peculiar power attributed to genius in the majority of cases resolves itself into the orderly, purposeful collection of data and clear thinking with reference to their interpretation. The range of such ability is manifestly a wide one, and it is more pronounced in some than in others; but real "genius" is relatively rare, and for most persons, the great rank and file, capacity for discovery and accomplishment rests on the more prosaic basis of hard work.

Far from being discouraging, this is heartening because it gives encouragement to the average worker. To him success may come if he is content to do the small things well, to select a subject and hold to it, casting aside for the time being other suggestions that lead into side lines, and discriminating in the kind of data to be brought together for his purpose.

Because a person is painstaking and patient does not signify that he will display genius or do notable things. On the other hand, because some one of unusual mental powers enters upon the investigation of a subject, it does not follow that discovery will result if other essential qualities are omitted. Genius can not take the place of painstaking and discriminating effort, and on the other hand, experiments and observations alone may not suffice to solve the complex questions presented in a subject like agriculture. Head and hand must work together to give direction and effectiveness as well as the proper scope and accuracy—to guide the accumulation of evidence. This means taking pains to a purpose, and it is the most helpful short cut that most persons may employ.

The vision and imagination applied in original inquiry are the means of supplying the plan and looking forward to see what may be expected. Perhaps this is where special genius for investigation is most often displayed.

It was long a popular belief that the investigator should studiously refrain from anticipating his results or going beyond the observed facts. This was expressed in the early days of agricultural investigation by the theory that preconceived notions should be avoided. It was thought by many to be highly unscientific to look ahead to what the results of experiment might show, since to do so might lead to the danger of bias in observation and interpretation. The implication was that the experimenter's mind was to be devoid of any theoretical notion or fixed idea—that he was putting the question to nature and would let nature answer through the experiments.

But, obviously, if we put the question to the soil or the plant or animal it must be so framed as to give a clear, intelligible answer, one which will not be misinterpreted. The conditions under which the experiments are made must be well defined and controlled, for the experiments themselves are only means to an end and contribute in proportion as they are competent to add accurate and reliable facts. The results may easily be misconstrued unless they are guarded, and they may turn out to be inadequate or incompetent to the needs of the case. This has often proved to be true, and it is a special reason for critical study of the data as they are secured, instead of allowing them to accumulate for considerable periods.

Data are derived for use, either directly or indirectly. The manner in which they are used determines their value for the time being, but what they disclose or suggest depends to considerable extent on the personal equation. Observations and experiments are themselves sometimes mistaken for research, whereas they are the building blocks of which it is constructed, and it is what is put into them in the way of design that makes them part of a live and aggressive effort.

After the general background has been secured, every constructive experiment looks ahead, is a conscious attempt to prove or disprove a suggestion, and in more involved investigation is purposely designed to test a theory or hypothesis. There is no occasion, therefore, to fear the effects of preconceived notions, but on the contrary, such a projection of ideas in making experiments is a part of the process of research.

Progress rests upon the establishment of facts, but as Huxley has said, "those who refuse to go beyond fact rarely get as far as fact"; and he shows that all students of the history of science know that almost every step has been made by an "anticipation of nature,"

that is, "by the invention of hypotheses which, although verifiable, often had very little foundation to start with, and not infrequently in spite of a long career of usefulness turned out to be wholly erroneous in the long run."

While, therefore, success in research depends on painstaking experiments and observations, their adaptation to meet the changing needs as the work advances is quite as important as their accuracy. Though such experiments may be long continued, they deserve to be critically studied both as to what they disclose and what added steps they suggest. This prevents indiscriminate effort, or the continuance of experiments which have failed to be productive of new facts or ideas.

Although the hypothesis plays such an essential part in the painstaking process of research, it is speculative, a product of imagination and theorizing. In reference to this Dr. L. H. Bailey points out in one of his essays that "a lively imagination is indispensable in persons of the best attainments in science; it is necessary only that the imagination be regulated and trained." And he adds that "all great engineers, chemists, physiologists, physicists, work in the realm of imagination, imagination that projects the unknown from the known. Almost do we think that the Roentgen ray, the wireless telegraph, the analysis of the light of the stars, the serum control of disease, are products of what we might call pure fancy." It is in this realm of fancy that what is popularly regarded as genius is most often expressed.

Constructive research, therefore, depends on a continued influx of new ideas, a development of the point of view, a more intimate insight into the problem. It depends on originality in the progressive planning of experiments, so that advance may be made with the least amount of lost motion or unnecessary effort. Unless this course is followed, experiments become stereotyped, lose direction, become purely subjective. They cease to contribute directly to research or to be a profitable means of advance. They end in comparisons, instead of going beyond themselves in the attempt to replace empirical fact with scientific truth.

Experimental inquiry is as much a matter of method as of reasoning, of plan as of execution. All are part of what is involved in the taking of infinite pains. Guided by imagination they enable the product which is popularly accorded the stamp of genius.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Some proteins from the mung bean, Phaseolus aureus Roxburgh, C. O. JOHNS and H. C. WATERMAN (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 303–317*).—The authors report a study of the proteins of the mung bean (*P. aureus*) by a procedure similar to that previously noted (E. S. R., 43, p. 410).

The mung bean was found to contain about 21.74 per cent of protein. A yield of about 19 per cent of protein calculated on the dry weight of the meal used was obtained from the finely ground seed by extraction with 20 volumes of 5 per cent NaCl solution. A very small yield of albumin (0.05 per cent) was obtained by coagulation. By fractional precipitation of the extract with ammonium sulphate α- and β-globulins were obtained to the extent of 0.35 and 5.75 per cent, respectively, of the dry material extracted. The percentages of the basic amino acids in the two globulins, as determined by the Van Slyke method, are given in the following table:

Basic amino acids in the mung-bean globulins.

Amino acid.	α—Globulin.		β—Globulin.		
	I	II	I	II	III
	Per cent	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*
Cystin	1 44	1.53	0.00	0.00	0.00
Arginin	5 14	5.11	7 54	7.53	7.62
Histidin	3 26	3.35	1 97	2.04	2.04
Lysin	6 07	6 09	9 07	8 96	9.84

Hydrolysis of the globulin of the coconut, Cocos nucifera, D. B. JONES and C. O. JOHNS (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 291–301*).—In this study a departure was made in the usual order of procedure in the analysis of the hydrolysis products of proteins, the various steps employed being as follows: "Removal of the hexone bases with phosphotungstic acid, separation of most of the glutaminic acid as the hydrochlorid, precipitation of the remaining dibasic amino acids as their calcium salts, extraction of prolin and peptid anhydrids with absolute alcohol, and esterification of the remaining amino acids by means of the lead salt method of Foreman [E. S. R., 43, p. 202]." The following values were obtained: Glycin trace, alanin 4.11 per cent, valin 3.57, length 5.96, prolin 2.85, phenylalanin 2.05, aspartic acid 3.88, glutaminic acid 18.69, serin 1.41, and leucylvalin anhydrid 0.14 per cent.

By using the highest percentages obtained from this and the analysis reported in the preceding paper and adding the values for basic amino acids as reported in a previous paper by Johns et al. (E. S. R., 40, p. 502), the identified and determined hydrolysis products of the coconut globulin total 78.15 per cent. This is thought to be among the highest figures thus far obtained in the analyses of the hydrolysis products of protein.

Some amino acids from the globulin of the coconut as determined by the butyl alcohol extraction method of Dakin, C. O. Johns and D. B. Jones (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 283–290*).—Coconut globulin, prepared as described in a previous contribution from the Bureau of Chemistry, U. S. Department of Agriculture (E. S. R., 40, p. 502), was subjected after hydrolysis to butyl alcohol extraction according to the method of Dakin (E. S. R., 40, p. 611) after removal of the diamino acids and most of the glutaminic acid, and determinations were made of the amino acids remaining in the aqueous solution. The following values were found: Glutaminic acid 19.07, aspartic acid 5.12, alanin 2.67, and serin 1.76 per cent. No hydroxyglutaminic acid or glycin could be detected. From the amino acids extracted by the butyl alcohol 5.54 per cent of prolin and 0.64 per cent of leucylvalin anhydrid were isolated.

Dihydroxyphenylalanin, a constituent of the velvet bean, E. R. Miller (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 481–486*).—The author, at the Alabama College Experiment Station, has extracted from the powdered seed of the Early Speckled or Georgia velvet bean, by methods similar to that described by Torquati (E. S. R., 32, p. 112), a crystalline substance conforming in its properties to 3–4–dihydroxyphenylalanin. Most of the reactions given by this substance were also given by the aqueous extracts of 26 varieties of velvet beans obtained from the Alabama, Georgia, and Florida Stations. Seeds from several species of other genera of the family Leguminosæ were tested in the same way with negative results. The conclusion is drawn that this amino acid is a characteristic constituent of the seeds of plants of the genus Stizolobium.

Attention is called to the fact that this substance is closely related to adrenalin, and that it is probable that long continued feeding of velvet beans might cause harmful results.

Amino acids of gelatin, H. D. Dakin (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 499–529, fig. 1*).—This is a detailed report of an investigation of the hydrolysis products of gelatin by the butyl alcohol extraction method previously noted (E. S. R., 40, p. 611). The quantitative results obtained were as follows: Glycin 25.5 per cent, alanin 8.7, aminobutyric acid none, valin none, isoleucin none, leucin 7.1, serin 0.4, phenylalanin 1.4, tyrosin 0.01, prolin 9.5, hydroxyprolin 14.1, aspartic acid 3.4, glutamic acid 5.8, hydroxyglutamic acid none, histidin 0.9, arginin 8.2, lysin 5.9, and ammonia 0.4 per cent. To this could be added considerable amounts of serin and possibly allied substances which could not be separated from the hydroxyprolin and some unidentified sulphur derivatives.

In the course of the analysis two new substances were isolated, γ-hydroxyprolylprolin anhydrid and inactive prolin hydantoin. The preparation and chemical characteristics of these substances are described.

Certain factors that influence acetone production by Bacillus acetoethylicum, C. F. Arzberger, W. H. Peterson, and E. B. Fred (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 465–479, figs. 2*).—An extensive study is reported of the products formed, the factors influencing the end products, and the relation of these products to one another in the production of acetone by *B. acetoethylicum*, a study of the biochemistry of which by Northrop et al. has been previously noted (E. S. R., 41, p. 415).

Glucose, sucrose, potato starch, and xylose in 2 per cent solution in a 0.5 per cent peptone, 0.1 per cent dipotassium phosphate medium were fermented with the production of acetic, formic, and lactic acids, ethyl alcohol, acetone, and carbon dioxid. From 75 to 80 per cent of the carbohydrate was fermented within from 10 to 15 days. The reaction of the medium was found to have a very marked effect upon the products farmed. The optimum reaction for acetone with the production of acetic, formic, and lactic acids, ethyl alcohol, acetone, production was at pH = 5.8 to pH = 6. At a reaction of about pH = 8 large

amounts of volatile acids were formed with correspondingly small amounts of alcohol and acetone. The volatile acids were composed of about 45 per cent formic and 55 per cent acetic acid. Small amounts of nonvolatile lactic acid were also produced. Ethyl alcohol, with traces of some higher alcohols, was produced in amounts varying from 8 to 25 per cent, depending upon the reaction.

"Potato starch medium when inoculated with *B. acetoethylicum* is first liquefied and then goes through a process of hydrolysis. No reducing sugars have been detected in a fermenting culture of this kind. Cultures previously treated with toluene, or freed from organisms by filtration, also produced similar changes in a starch medium. Traces of reducing sugars were found, and a characteristic red color was always produced when treated with iodin solution. The hydrolysis of starch into dextrin-like substances indicates the liberation of enzyms by the bacterial cells which function as hydrolytic agents. The negative tests for reducing sugar do not exclude the probability of their formation during bacterial activity, for the sugars may be utilized by the organism as rapidly as they are formed."

Naphthalene sulfonic acids.—I, Some difficultly soluble salts of certain naphthalene sulfonic acids, J. A. Ambler (*Jour. Indus. and Engin. Chem., 12 (1920), No. 11, pp. 1081–1085*).

Napthalene sulfonic acids.—II, A method for the qualitative detection of some of the naphthalene sulfonic acids, J. A. Ambler and E. T. Wherry (*Jour. Indus. and Engin. Chem., 12 (1920), No. 11, pp. 1085–1087*).

A new instrument (microcolorimeter and nephelometer), A. Baudouin and H. Bénard (*Compt. Rend. Soc. Biol.* [Paris], *83 (1920), No. 15, pp. 602, 603*).—The apparatus described is a reduction of the Duboscq colorimeter to a size suitable for use in micro determinations. The cups have a capacity of 2 cc. and the tube an adjustment of 20 mm. The apparatus can also be used as a nephelometer or ultraphotometer, and, by replacing the ocular with a small direct-vision spectroscope, can be transformed into a spectroscope comparator.

Dicyandiamid: A rapid, direct method for its determination in cyanamid and mixed fertilizers, R. N. Harger (*Jour. Indus. and Engin. Chem., 12 (1920), No. 11, pp. 1107–1111, figs. 3*).—A direct method of determining dicyandiamid (cyanoguanidin) applicable to mixed fertilizers has been developed following the discovery that when a solution of silver picrate is added to a solution of dicyandiamid the latter is quantitatively precipitated as a double compound having the formula $C_6H_2(NO_2)_3OAg.C_2H_4N_4$. This substance, to which the name silver picrate-mono-cyanoguanidin has been given, forms in small yellow crystals, the exposed surfaces of which, when viewed under the low-power microscope, have the appearance of slightly oblique parallelograms with four lines drawn from the four corners and meeting at the center. Another property which it is thought should prove useful in qualitative tests for dicyandiamid is the formation of a gel quickly changing to crystals when silver picrate is added to solutions of dicyandiamid containing from 0.4 to 4 mg. per cubic centimeter. If the solution of dicyandiamid is more concentrated, a second double compound, silver picrate-dicyanoguanidin, $C_6H_2(NO_2)_3OAg.2C_2H_4N_4$, may be formed. Cyanamid and urea give no precipitates when their solutions are tested with silver picrate and thus do not interfere with the determination of dicyandiamid

The technique of the proposed method as applied to commercial calcium cyanamid is essentially as follows: From 5 to 10 gm. of the substance is shaken with 300 cc. of water for from ½ to 1 hour. Dilute nitric acid is added until the mixture is slightly acid to litmus, then 75 cc. of 5 per cent silver nitrate solution, and the whole is made up to 500 cc. and filtered. For the analysis a 100 or 200 cc. aliquot of the filtrate is treated in a beaker with 100 cc. of saturated picric acid solution. The mixture is stirred vigorously for 2 or 3 minutes

to prevent the formation of a gel and the beaker then placed in ice water for 30 minutes, after which the precipitate is filtered on a weighed Gooch crucible provided with a thin pad of asbestos. Crystals adhering to the side of the beaker are washed out with a small amount of a saturated solution of pure silver picrate-mono-cyanoguanidin. After washing the precipitate once or twice with a little ether it is dried in the oven for 30 minutes at 100°, cooled in the desiccator, and weighed. To the weight of the precipitate is added 0.0044 gm. for each 100 cc. of the solution from which the crystals were filtered. The total weight divided by 5 gives the quantity of dicyandiamid in the solution analyzed.

In determining the content of dicyandiamid in mixed fertilizers a 20 gm. sample is mixed with 50 cc. of water. To this are added 100 cc. of a saturated solution of barium nitrate and sufficient saturated barium hydroxid to render the mixture alkaline to litmus. After agitating for 30 minutes the mixture is made up to 500 cc. and filtered through a fluted filter and the analysis made with a 200 cc. portion of the filtrate.

Two methods for determining borax in mixed fertilizers compared, H. H. Hill (*Virginia Sta. Rpt. 1919, pp. 28–32*).—The methods tested were those of Ross and Deemer (E. S. R., 42, p. 313) and of Carpenter, Breckenridge, and Magruder. In the latter method the boron is liberated as methyl borate and the solution made alkaline with sodium hydroxid, evaporated and ignited, after which mannitol is added and the solution neutralized with N/10 NaOH. This method was found unsatisfactory owing to losses during ignition, even on keeping the heat well below redness.

The method of Ross and Deemer gave satisfactory results with pure and mixed salts containing no organic matter, but with mixed fertilizers determinations by different analysts gave widely varying results. By evaporating and igniting the filtrate from the barium precipitate before titration to destroy organic matter concordant results were obtained.

"It is believed that with certain slight modifications in the details of the procedure, this method will be of great value in the determination of borax in mineral salts and mixed fertilizers. Unless a better method of purification of certain of the American potash salts used in fertilizer mixtures is sought, the ruling now in practice relative to the quantity of borax allowed in these mixtures makes the determination of borax imperative."

The determination of inorganic constituents of organic compounds, particularly those containing phosphorus, J. Grossfeld (*Chem. Ztg., 44 (1920), No. 45, pp. 285, 286; abs. in Chem. Abs., 14 (1920), No. 17, pp. 2600, 2601*).—Attention is called to the difficulties in obtaining a satisfactory ash from organic substances containing potassium phosphate and silica and also such compounds as lecithin and phosphatids. For overcoming these difficulties, the author has found the addition of a known amount of a solution of magnesium acetate satisfactory. The solution is made by dissolving 50 gm. of magnesium in an excess of acetic acid and diluting to 1 liter. To determine the deduction to be made from the ash for the magnesium acetate added, 20 cc. of the solution is pipetted into a platinum dish, dried on the water bath and then in the oven at 100 to 120° C., and weighed. In ash determinations of substances difficultly combustible 5 gm. of the material is treated with 20 cc. of the magnesium acetate solution, dried, heated, and ashed. From the weight of the ash is deducted the weight of ash obtained in the preliminary test. The analysis of the ash can be made by the usual methods.

In the case of lecithin or phosphatids the ash contains all of the phosphorus in the form of magnesium phosphate $Mg_3(PO_4)_2$. On dissolving this ash in dilute HCl or HNO_3 the phosphorus can be determined by the molybdic acid method or in the form of magnesium pyrophosphate.

The determination of traces of bromin in organic matter, A. Damiens (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 17, pp. 799–802; abs. in Chem. Abs., 15 (1921), No. 2, p. 219*).—A method for the determination of bromin in organic matter is described which is said to permit the estimation of as little as 0.005 mg. of bromin in 10 cc. of solution. The method involves the oxidation of the dried material with potassium nitrate and sodium carbonate, extraction with water, and the determination of iodin in an aliquot of the extract. Chlorin and bromin are determined similarly in another portion, the bromin being estimated colorimetrically.

The normal existence of chlorin and bromin in animal tissues, A. Damiens (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 19, pp. 930–933*).—The method noted above has been applied to the estimation of bromin and chlorin in the blood and various organs of different animals. Bromin was found in all the organs examined except in certain cases where the amount of material available was so small that the proportion of bromin did not exceed the limits of experimental error. The ratio of bromin to chlorin in all the organs of a given animal was found to be practically constant, but to vary with different animals. No accumulation of bromin in the thyroid gland similar to the accumulation of iodin was found.

Method for the quick and accurate estimation of the moisture content of fats and oils, H. Oertel (*Chem. Ztg., 44 (1920), No. 137, p. 854*).—The method described depends upon the fact that a definite amount of heat is evolved when a mixture of two parts of water-free magnesium sulphate and one part of Kieselguhr is treated with a definite amount of water. The rise in temperature of a known amount of the oil to be tested when stirred with a definite amount of this mixture is thus a measure of the water content of the oil.

Method of microchemical research for certain constituents of essential oils, R. Baudry (*Méthode de Recherche Microchimique pour Certains Constituants des Huiles Essentielles. Paris: Vigot Frères, 1919, pp. 154, figs. 55*).—This thesis deals with the separation from essential oils and the microscopic identification of methyl anthranilate and the anthranilate of methyl or the methyl esters of methyl anthranilic and anthranilic acids.

Detection and characterization of glucose in vegetable matter by a new biochemical procedure, E. Bourquelot and M. Bridel (*Jour. Pharm. et Chim., 7. ser., 22 (1920), No. 6, pp. 209–215*).—The method proposed is the reverse of the usual test for glucosid with the use of emulsin. The juice is treated with methyl alcohol and emulsin and the presence of glucose determined by the formation of crystals of methyl glucosid, which is identified by its specific rotatory power.

Contribution to the determination of sugar in urine: A rapid method, O. Mayer (*Arch. Hyg., 88 (1919), No. 4, pp. 184–197*).—The method described, which is an adaptation of Trommer's qualitative test, is essentially as follows:

To 10 cc. of urine in a graduated cylinder 10 cc. of a 15 per cent solution of NaOH is added and the volume made up to 50 cc. with water. The solution is titrated with a 2.5 per cent solution of pure $CaSO_4$ with gentle shaking until the resulting precipitate redissolves, leaving a slight but persistent turbidity. Each cubic centimeter of the $CuSO_4$ solution used corresponds under these conditions to 0.1 per cent of dextrose. If the concentration of sugar is over 4 per cent only 5 cc. of the urine should be used, while if it contains less than 1 per cent 20 cc. is recommended.

Further studies in the deterioration of sugars in storage, N. Kopeloff, H. Z. E. Perkins, and C. J. Welcome (*Jour. Agr. Research [U. S.], 20 (1921), No. 8, pp. 637–653*).—Previously noted from another source (E. S. R., 44, p. 115).

Palatable sirup from sugar beets, C. E. THORNE (*Ohio Sta. Mo. Bul., 5 (1920), No. 11-12, p. 294*).—The process described by Ort and Withrow (E. S. R., 42, p. 507) for making sugar-beet sirup in the home is quoted, and attention is called to the fact that this process is adapted only to conditions in which the labor factor does not enter into the computation of cost. It is recommended, however, as a means of making small quantities of sirup where it might not be practicable to produce sirup from home-grown sorghum on account of lack of facilities for grinding the cane.

Progress in the starch and fermentation industries during 1914 to 1919, W. LASKOWSKY (*Chem. Ztg., 44 (1920), Nos. 72, pp. 441-443; 73, pp. 451, 452; 75, pp. 462, 463; 78, pp. 478, 479; 79, pp. 486-489; 81, pp. 497-499; 82, pp. 505, 506*).—Following a discussion of the general state of the starch and fermentation industries in different countries during the period of the war, the author outlines briefly the principal contributions to special branches of these industries during this period. No literature references are included.

The history and development of the cottonseed oil industry in America, D. WESSON (*Amer. Inst. Chem. Engin. Trans., 12 (1919), pt. 2, pp. 13-38, figs. 62*).—An address delivered at the annual meeting of the American Institute of Chemical Engineers at Savannah, Ga., on December 4, 1919.

Fruit products (*California Sta. Rpt. 1920, pp. 49-51*).—The results of the study made by E. L. Overholser and W. V. Cruess on the chemical processes involved in the sulphuring of fruits, noted in the previous report (E. S. R., 42, p. 804), are summarized.

It has been found that the darkening of fruits through drying is caused by the union of oxygen from the organic peroxid in the fruit with the coloring matter of the fruit through the aid of the enzym oxidase, and that the sulphurous acid absorbed by the fruit during the process of sulphuring prevents this darkening by union with the peroxid as well as by action on the coloring matter. Darkening may also be prevented by heating the fruit to 185° F. or higher to destroy the peroxid or enzym or by the use of other reagents than SO_2, among the possibilities being cane sugar, glucose, salt, and citric acid.

The report also includes brief notes on a simple distillation method for estimating the moisture content of dried fruits which has been found to be sufficiently accurate for factory control; on the superiority in color, flavor, and general quality of jellies and preserves cooked in vacuo as compared to those cooked in an open kettle; and on the advantages of canning vegetables in brines slightly acidified with lemon juice, citric acid, or vinegar. A brief report is given of studies by Cruess, Overholser, and S. A. Bjarnason on the storage of perishable fruits at freezing temperatures (E. S. R., 44, p. 207).

The preparation of marketable vinegar, F. E. RICE (*N. Y. Agr. Col. (Cornell) Ext. Bul. 40 (1920), pp. 205-218, figs. 2*).—This publication, which gives full directions for the home manufacture of cider vinegar, emphasizes particularly the reasons for failure to obtain good vinegar and gives suggestions for correcting these faults. The subject matter also includes brief directions for the manufacture of grape vinegar and large-scale methods for manufacturing vinegar, prohibition regulations relating to the manufacture of vinegar, and State and Federal laws relating to its sale.

METEOROLOGY.

Report of the Chief of the Weather Bureau, 1920 (*U. S. Dept. Agr., Weather Bur. Rpt. 1920, pp. 284, pls. 7*).—The work of the Weather Bureau during the fiscal year ended June 30, 1920, is reviewed, and the general weather conditions and outstanding meteorological features of 1919 are given, includ-

ing the usual detailed tabular monthly and annual summaries of climatological data.

Attention is called especially to the limitations of funds and personnel under which the bureau labored during the year, and to lines along which its work might be profitably developed. It is pointed out that "every national activity, industry, and interest has become aroused to the immediate practical value of weather advices, warnings, forecasts, and information in the daily sequence of affairs."

Reference is made to a new enterprise of special agricultural significance which is being developed, namely, weather and rain insurance. The large losses of property from floods in 1919 are referred to as emphasizing the importance of river and flood warnings. The great deficiency of snow during the winter of 1919–20 in the mountain regions of the West forecast a shortage of water for irrigation and power the following year The work strictly defined as agricultural meteorology included as usual special forecasts and warnings and the collection and dissemination of information regarding the effect of meteorological conditions on crops and farm operations.

It is pointed out that the greatest need in connection with the development of agricultural meteorology is "the establishment of agricultural meteorological stations at the agricultural experiment stations in the principal crop-growing areas. When established a careful and systematic record can be begun of the temperature, rainfall, sunshine, etc., and at the same time a complete record of the development of the various crops. By maintaining these stations for a period of years, the most critical period of growth and the weather factor most affecting the crop can be determined."

Forecasting precipitation in percentages of probability, C. HALLENBECK (*U. S. Mo. Weather Rev., 48 (1920), No. 11, pp. 645–647, figs. 5*).—It is stated that "during the irrigating and alfalfa-harvesting periods the Weather Bureau office at Roswell, N. Mex., issues an amplification of the forecast, in which the probability of rain within 36 hours is expressed in percentages; 100 per cent representing absolute certainty of rain, and 0 per cent absolute certainty of fair weather."

The method of preparing these forecasts is described. "The basis of this method is a series of composite weather maps showing the frequency of precipitation, in percentages, with different types of pressure distribution. These maps are used only for reference, and are used in conjunction with the daily weather map. The percentage of probability of rain, as shown on the composite map, is usually modified—sometimes ignored altogether—in the forecast issued. Since, during the warmer months of the year, neither rain nor fair weather can often be forecast for this district with absolute certainty, this style of forecast is of value to the farmers in governing irrigation, and also, to a certain extent, in the harvesting of alfalfa."

Problems on the relation between weather and crops, L. D. VAUGHAN (*U. S. Mo. Weather Rev., 48 (1920), No. 11, pp. 641–643*).—A summary is given of observations and experiments needed to solve some of the many problems bearing on the relation of weather and crops.

Ground temperatures compared with air temperatures in a shelter, G. REEDER (*U. S. Mo. Weather Rev., 48 (1920), No. 11, pp. 637–639, fig. 1*).—"A series of observations was made at the U. S. Weather Bureau Station, University of Missouri, Columbia, during the months of September and October, 1907, to determine how much exposed thermometers on the ground differed from sheltered thermometers 11 ft. above the ground. To test the problem further, three beds were made, one of bare soil, one of blue-grass sod, and one

of sand. Observations made during the passage of cumulus clouds and upon the effect of a shade area 20 ft. distant showed that all the instruments responded to cloud shadows, but that only ground thermometers showed the effect of the building shadow. The latter shadow caused a perceptible movement of air toward the sunlit area. This paper serves to present the collected data from these observations."

The cooling of the soil at night, with special reference to late spring frosts, II, T. B. Franklin (*Roy. Soc. Edinb. Proc., 40 (1919–20), No. 1, pp. 10–22; abs. in U. S. Mo. Weather Rev., 48 (1920), No. 11, pp. 639, 640*).—In a previous paper on the subject, which was noted (E. S. R., 42, p. 214), the author "came to the conclusion that the temperature of the surface of open cultivated soil fell rapidly at the beginning of a calm clear night until it was such a number of degrees below the temperature at the 4-in. depth as to make the upward conduction from that depth to the surface balance the radiation. After this stage was reached the surface and 4-in. temperatures fell at the same rate. If, therefore, the temperatures of the surface and 4-in. depth and the conductivity of the layer of soil between the 4-in. depth and the surface were known from readings of electrical resistance thermometers, and the rate of radiation was calculated from the value of the relative humidity, I suggested that it might be possible to forecast the minimum soil temperature for a calm clear night as early as the previous afternoon."

In this second paper the author gives and discusses in some detail a formula for forecasting the minimum surface-soil temperature and compares the minima, so forecasted, with the observed minima on a number of calm clear nights. He concludes from the results that the formula will give "a very close degree of approximation when ideal conditions exist," and that by its use it is possible to forecast "the minimum temperature over open soil on calm clear nights, so far as to say whether there will be a frost or not, with a remarkable degree of exactitude."

The influence of forest areas in nonforested regions upon evaporation, soil moisture, and movement of ground water, I. T. Bode (*U. S. Mo. Weather Rev., 48 (1920), No. 11, pp. 657, 658*).—This is the author's abstract of a paper read at the 1920 meeting of the Iowa Academy of Sciences, with a brief discussion of it by R. E. Horton.

Monthly Weather Review (*U. S. Mo. Weather Rev., 48 (1920), Nos. 11, pp. 627–685, pls. 16, figs. 19; 12, pp. 687–745, pls. 16, figs. 17*).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for November and December, 1920, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 11.—Flying Weather in the Southern Plains States (illus.), by J. A. Reihle; Surface Winds and Lower Clouds, by F. E. Hartwell; The Highest Aerial Sounding, by W. R. Gregg; Local Peculiarities of Wind Velocity and Movement Atlantic Seaboard—Eastport, Me., to Jacksonville, Fla. (illus.), by S. L. Trotter; Ground Temperatures Compared with Air Temperatures in a Shelter (illus.), by G. Reeder (see p. 715); Problems on the Relation between Weather and Crops, by L. D. Vaughan (see p. 715); Forecasting Precipitation in Percentages of Probability (illus.), by C. Hallenbeck (see p. 715); Monthly Variations of the Precipitation-Altitude Relation in the Central Sierra Nevada of California (illus.), by B. M. Varney; Flood Crests on the Ohio and Mississippi and Their Movement (illus.), by A. J. Henry; Rules for Forecasting the Crest Stages at Vicksburg, Miss., Based upon the Stages at Cairo, Ill. (illus.), by H. W. Smith; and Typhoon in the Philippines, by J. Coronas.

No. 12.—Atmospheric Environment and Health, by L. Hill; Note in Regard to Indoor and Outdoor Humidity, by J. R. Weeks; Note in Regard to the Primary Cause of Colds, by J. R. Weeks; Comparison of Temperature and Humidity during 1920, with the Mean and Their Relation to Comfort, at Anaconda, Mont. (illus.), by C. D. Demond; The Rate of Ascent of Pilot Balloons (illus.), by B. J. Sherry; Vertical Current Directed by Comparing Cloud Motion with Apparent Speed of Pilot Balloon (illus.), by J. Leshan; The Making of Upper-air Pressure Maps from Observed Wind Velocities (illus.), by C. L. Meisinger; The Weather Factor in Aeronautics (illus.), by C. L. Meisinger; Certain Relative Insolation Values, by W. J. Humphreys; Influence of Exposure on Temperature Observations (illus.), by F. D. Young; The Comparison of the Indications of Some House Thermometers in Winter, Results of Observations (illus.), by H. I. Baldwin; Temperature and Relative Humidity in Cold Storage Plants for Eggs and Candy, by O. T. Lay; The Distribution of Climatological Stations, by C. J. Root; and A Comparison of Two Types of Evaporation Pans, by G. A. Loveland.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 7 (1920), Nos. 9, pp. [201], pls. 4, fig. 1; 10, pp. [201], pls. 4, figs. 2*).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for September and October, 1920, respectively.

Climatic conditions [on the Huntley, Mont., Reclamation Project Experiment Farm, 1919], D. Hansen (*U. S. Dept. Agr., Dept. Circ. 147 (1921), pp. 4, 5*).—Observations on temperature, killing frosts, precipitation, and wind velocity during 1919 are compared with similar data for the previous nine years. The rainfall from April to August, inclusive, was 2.84 in. as compared with the 9-year average of 7.56 in. The total for the year was 12.22 in. as compared with the 9-year average of 13.97 in. The months of June and July were unusually hot, a maximum temperature of 107° F. being recorded, which is the highest since the farm was established. The frost-free period was unusually long, extending from May 7 to September 27.

Meteorology, 1916, W. Frear and C. A. Kern (*Pennsylvania Sta. Rpt. 1917, pp. 410–450, 489–512, pls. 2*).—The usual observations on pressure, temperature, precipitation, cloudiness, and frostless period at State College, Pa., are summarized and discussed for 1916 as in previous reports (E. S. R., 43, p. 511).

SOILS—FERTILIZERS.

Soil studies.—I, Soil sampling.—II, Residual potash in fertilized soils, W. Frear and E. S. Erb (*Pennsylvania Sta. Rpt. 1917, pp. 373–404, pls. 8*).—The first part of this report deals with studies of methods of sampling soils which were undertaken primarily for the purpose of obtaining representative samples of soils for the potash study presented in the second part of the report.

In studies of the excavation method of sampling it was found that the probable error of the so-called sand method of measurement does not exceed 1.23 cc. in 4,460 cc., or $\frac{1}{3626}$ of the whole. It is possibly no greater than $\frac{1}{3600}$. In 44 separate determinations of soil density made on neighboring plats on the same tract of land, the extremes differed by fully one-sixth of the average density. The average densities calculated severally for two series of determinations of 11 samples each differed from one another by only from $\frac{1}{80}$ to $\frac{1}{120}$ of the average weight. Because of the variability of the soil it is considered more important to base the estimation of soil density upon a considerable number

of quite careful measurements than it is to secure the utmost nicety of single observations at the expense of frequency of repetition.

In studies of the boring method of sampling it was found that the percentages of fine soil in composite samples made up from 40 borings each taken symmetrically over $\frac{1}{8}$-acre areas may differ by $\frac{1}{10}$ of the entire amount of fine soil. On the silty loam soil with cherty fragments studied, composites of 60 borings contained practically the same percentage of fine soil as composites of 80 borings to the $\frac{1}{8}$-acre area. "Even on such soil, samples taken by boring carry too large percentages of fine soil and too little of the coarse and medium fractions. As much as one-half the fragments coarser than 3 mm. in diameter may be excluded, and one-eighth or more of the fragments of diameters between 3 and 1 mm. For such soils, therefore, boring samples will probably, when used for mechanical analysis, exhibit too little 'gravel.' This defect would doubtless affect more largely boring samples taken from shaly, sandy, or gravelly soils."

With respect to dry matter lost upon ignition of the fine soil, the extreme difference between duplicate determinations was 0.072 per cent and the average 0.034 per cent. These percentages are, respectively, equal to about $\frac{1}{50}$ to $\frac{1}{100}$ of the total dry matter thus lost. The highest difference in dry matter lost on ignition, by composites of 11 subsamples each taken from the same plat, was 0.397 per cent, or nearly six times the maximum error in preparation and analysis. The maximum difference between similar composites made from 40 borings each was only 0.091 per cent, or little more than the extreme analytical error.

Part 2, on residual fertilizer potash in silt loam soil, has been previously noted from another source (E. S. R., 40, p. 25).

Soil survey of the Willits area, Calif., W. C. Dean (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 32, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 19,200 acres situated in the central part of Mendocino County, about 120 miles northwest of San Francisco.

The area comprises the Little Lake Valley and a part of the surrounding hilly and mountainous country. The main valley part of the area is an oval basin with the lowest depression at the northern end. The hills and mountains rise rather abruptly around the sides and are gently sloping to steep. Regional drainage is ample in all except the lower northern end of the valley.

The arable soils of the area are classified as residual, old valley filling, and recent alluvial soils. Including rough mountainous land, nine soil types of six series are mapped, of which rough mountainous land covers 36 per cent, Yolo loam 23.3 per cent, and Willits fine sandy loam 15.3 per cent of the area.

Soil survey of the Millville area, N. J., C. C. Engle et al. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 46, pls. 8, figs. 2, map 1*).—This survey, made in cooperation with the Department of Conservation and Development of New Jersey and the New Jersey Experiment Station, deals with the soils of an area of 641,280 acres in the extreme southern part of New Jersey, which includes all of Cape May County, two-thirds of Atlantic County, about three-fourths of Cumberland County, and small parts of Gloucester and Salem Counties.

The area as a whole is flat to gently undulating and is characterized by a lack of relief. Nearly all parts of the area are said to have adequate drainage except certain flat regions of the main divide. All the rivers are tidewater streams for from 5 to 15 miles from their mouths, and their tributaries, which penetrate all parts of the area, have their sources in or flow more or less sluggishly through low, swampy areas.

The area lies wholly within the Coastal Plain province, and the soils have been derived from unconsolidated material and are predominantly sandy. Including tidal marsh, swamp, coastal beach, reclaimed tidal marsh, and made land and clay pits, 18 soil types of 6 series are mapped, of which the Sassafras sand, tidal marsh, and Sassafras gravelly sandy loam cover 32.3, 18.3, and 11.9 per cent of the area, respectively.

Biennial report, Oregon soil investigations, 1918–1920 (*Oregon Sta., Soil Invest. Bien. Rpt., 1919–20, pp. 46, figs. 37*).—This report briefly discusses the investigations conducted by the station in soils and the results secured during the biennial period from 1918 to 1920, describes investigations under way which should be continued, and draws attention to other investigations which should be undertaken. A summary of publications on soil subjects issued by the station during the biennium is given.

The progress report of soil projects under way includes cooperative soil and feasibility surveys and improvement work, drainage and irrigation investigations, and soil-fertility investigations. Practical results from these investigations are summarized, indicating, among other things, the development of the practical use of sulphur on alfalfa in arid and semiarid regions. Nitrogen may be profitably used in orchard sections and potash on potatoes in central Oregon, while phosphorus has been found to pay on the red hill soils and worn grain lands of the more humid sections. It was found that the soils in the latter section are acid, and that legumes were benefited by the use of ground limestone. It is stated that sulphur was used the last year of the period on 16,000 acres and made an average increase of at least 1 ton of alfalfa per acre.

Effect of various crops upon the water extract of a typical silty clay loam soil, G. R. Stewart and J. C. Martin (*Jour. Agr. Research* [*U. S.*], *20* (*1921*), *No. 8, pp. 663–667, figs. 5*).—In a contribution from the California Experiment Station, studies on the effect of crops of corn, horse beans, potatoes, turnips, and barley upon the water extract from a typical silty clay loam soil throughout the growing season are reported. All the crops reduced the concentration of the soil water extract during the height of the growing season, the nitrate content being reduced to a very low figure.

Studies of the concentration of the soil solution by means of observations of freezing-point depressions in the immediate vicinity of and at a distance from the plants showed that the concentrations are not significantly reduced until the portion of the soil sampled is filled with plant roots.

Experiments with muck soils in growing greenhouse crops, H. C. Thompson (*Jour. Amer. Peat Soc., 14* (*1921*), *No. 1, pp. 45–63, pls. 3*).—Studies conducted by the U. S. Department of Agriculture on different kinds of mucks and experiments to determine their value as greenhouse soils are reported.

Soils from three different tracts in New Jersey, Michigan, and Indiana, representing different types of mucks, were used. Analyses showed these mucks to be deficient in potash but well supplied with lime and nitrogen. The crops used were lettuce, cauliflower, tomatoes, roses, and carnations. The mucks were used alone and in different mixtures with sand and clay.

There was considerable inconsistency in the results obtained, and the yields from the same soil mixtures varied widely. In spite of the inconsistencies noted, it is believed that a good type of muck is a valuable greenhouse soil. While the pure muck produced good results, it is considered undesirable under most conditions to use a mixture containing more than one-half or possibly one-fourth muck. Greenhouse practice would probably require an application of from 2 to 3 in. of muck to the surface soil as a substitute for manure. The muck should be supplemented with potassic and phosphatic fertilizers. Where

fertilizer was used one-fourth muck in the soil mixture gave as good results as one-third manure.

It is considered evident that chemical analyses do not indicate the productiveness of muck soils, as in most cases the soils containing the smallest amounts of nutritive constituents produced the largest yields. The stage of decomposition of muck soil apparently has more influence on crop production than the total content of nutritive constituents. The more advanced the stage of decomposition the better the soil was for crop production.

Relation between the heat value of peat and its degree of decomposition, KEPPELER (*Mitt. Ver. Förd. Moorkult. Deut. Reiche, 38 (1920), No. 18, pp. 312–316, fig. 1*).—Continuing studies on the influence of degree of decomposition on the different properties of peat (E. S. R., 43, p. 213), it was found that the heat values of samples of six different peats, taken at varying depths, corresponded closely with the degree of decomposition as determined by the so-called percentage-of-total-reduction method previously described. The same general relation was established in studies of mixed samples from individual moors. A close relation was not established between specific weight and degree of decomposition, owing to the small variations in the degree of decomposition of the samples used. This feature of the work is being continued.

Alkali investigation (*California Sta. Rpt. 1920, pp. 84–86*).—Considerable data from studies of the reclamation of alkali soils in Utah, Arizona, and Nevada as well as California are briefly summarized, the conclusion being drawn that where only white alkali is to be considered it can at least in some cases be successfully removed by flooding and drainage. Where black alkali is present, as is often the case in California soils, there is little hope of success by this method. This has been borne out by experiments on the Kearney ranch.

Soil management and fertilization, M. NELSON and W. H. SACHS (*Ark. Agr. Col. Ext. Circ. 97 (1920), pp. 25*).—The chief essentials in the intelligent management and fertilization of Arkansas soils are presented and discussed as developed at the Arkansas Experiment Station.

It is stated that the greatest weakness in Arkansas agriculture is the lack of any well-defined system of soil management, and that improvement in this respect must be based on crop rotation, better tillage, increasing the supply of organic matter, and proper fertilization. Lime should be applied to legumes rather than to cotton and grain, and manure is considered to be the best fertilizer, although ultimately it must be supplemented by some form of phosphate for maximum results. Green manure is said to be next in importance to barnyard manure for Arkansas soils, followed in order by the nutritive elements nitrogen and phosphorus. It is also noted that in a majority of seasons the moisture supply in the soil becomes the greatest limiting factor in crop production.

The Illinois system of permanent soil fertility as developed by Cyril G. Hopkins, R. STEWART (*Illinois Sta. Circ. 245 (1920), pp. 20, figs. 5*).—This circular presents an address delivered at the so-called "fertility school" at the Ohio Experiment Station in June, 1920, and describes the Illinois system of permanent agriculture. It is brought out that the basis of this system is the addition to the land of somewhat larger amounts of fertility than are removed by cropping and by natural causes, and recognition of the economic necessity of employing the cheapest available materials for this purpose, attention being confined mainly to the limiting element in the particular soil in question.

Following a discussion of the factors of crop production, the elements of plant food, and the plant-food requirements of farm crops, data on the plant-food content of representative Illinois soils are briefly summarized, indicating that they vary widely in composition and that of the inorganic elements of plant-food phosphorus is the most limited. As measured by plant requirements, magnesium

is often more limited than potassium. In the case of peat soils, however, potassium is markedly limited and is considered to be the controlling factor in crop production.

Attention is especially drawn to the necessity for organic matter and nitrogen in the soil, and the results of experiments on different fields of the Illinois Station are summarized to show that the nitrogen requirements of crops on fully treated plats are met by the legume nitrogen in crop residues, and that the addition of commercial nitrogen produces practically no beneficial results. Where limestone is not naturally present, its addition to the soil in the form of finely ground natural rock is said to be the fundamental basis of the Illinois system, and its liberal use is considered to be an extremely profitable form of investment.

The live-stock and grain systems of farming are discussed, and it is stated that the fertility of the soil may be maintained on a permanent and profitable basis in either system.

The general use of potassium on Illinois soils is considered to be unnecessary except on such abnormal soils as peat. The Illinois system makes abundant use of raw rock phosphate, which is considered to be fully as effective and considerably cheaper per unit of phosphorus than acid phosphate, bone meal, or basic slag. The use of crop stimulants in the form of mixed fertilizers, which tend to exhaust the supply of one of the fertility elements in soil, is condemned.

The effect of fertilizers on the germination of seeds, T. B. HUTCHESON and T. K. WOLFE (*Virginia Sta. Rpt. 1919, pp. 33–37*).—Studies on the effect of different methods of applying fertilizers on the germination of seed showed that this effect depends to a large extent on the soil type and kind of seed used.

It was found that in nine instances on the Hagerstown silt loam soil germination was higher than on the Norfolk sandy loam soil. In nine cases the reverse was true. Of the nine instances of the higher germination on the Hagerstown silt loam, five occurred when the seed was planted in the row with the fertilizer and four when the fertilizer was broadcast. This occurrence was reversed on the Norfolk sandy loam. There were 57 instances of decrease and 46 instances of increase of 4 per cent or more in germination on the Hagerstown silt loam soil, and on the Norfolk sandy loam soil there were 84 instances of decrease and 33 instances of increase.

On the Hagerstown silt loam fertilizers applied in the row were generally more injurious than broadcast fertilizers, with the exception of acid phosphate. This was also true on Norfolk sandy loam, with the exception of potassium sulphate and acid phosphate. On both soil types the germination of corn was not materially reduced by fertilizers, with the exception of lime placed in the row on Norfolk sandy loam. Soy beans were substantially lowered in germination by all fertilizers except acid phosphate on Hagerstown silt loam. In the case of wheat, rye, and oats the effect of the different fertilizers applied was not very decided on either soil type. Fertilizers applied in the row were especially injurious to timothy in the Hagerstown silt loam and much less injurious in the Norfolk sandy loam. The reverse was true with redtop. With a few exceptions, fertilizers applied either broadcast or in the row did not lower the percentage of germination of alfalfa and red clover on the Hagerstown silt loam, but the injurious effect was pronounced on the Norfolk sandy loam, especially when the fertilizers were applied in the row. The practice of mixing alfalfa and clover seed with the fertilizer before seeding is considered to be inadvisable.

Lime was especially detrimental when applied in the row with the seed. Acid phosphate decreased germination in eight instances, six times on the Norfolk sandy loam and twice on the Hagerstown silt loam. Potassium sulphate

decreased germination in four instances on Hagerstown silt loam and in eight instances on the Norfolk sandy loam. A decrease in germination from applications containing either sodium nitrate or potassium chlorid or both was noticeable in many cases.

Soil investigation (*California Sta. Rpt. 1920, pp. 66, 67*).—Investigations by W. P. Kelley showed that on certain plats of soil practically no fertilizer, with the exception of nitrogen, had penetrated below the first foot after 12 applications. This work thus far suggests the desirability of incorporating fertilizing materials more deeply in the soil than is commonly done in orchard practice.

Studies by G. R. Stewart on 13 soils indicated that a considerable number of these soils showed significant losses of water-soluble phosphorus.

Commercial fertilizers, E. F. Cauthen (*Alabama Col. Sta. Rpt. 1920, pp. 15, 16*).—A comparison of calcium cyanamid, ammonium sulphate, ammonium nitrate, and sodium nitrate on cotton showed ammonium sulphate to be slightly better than the other fertilizers, followed by ammonium nitrate. Calcium cyanamid gave the poorest results. Equal amounts of nitrogen from sodium nitrate, calcium cyanamid, and ammonium sulphate, when these fertilizers were applied to cotton continuously for 13 years, gave the best results in 1920 when applied in the form of calcium cyanamid. The long-continued use of ammonium sulphate was harmful.

A 12-year comparative test of acid phosphate and raw phosphate gave results for the year slightly in favor of the former. Sodium nitrate and ammonium sulphate gave the best results on oats when applied February 20, while calcium cyanamid gave the best results when applied March 10.

Phosphoric acid assimilation and soil reaction, M. Wrangell (*Landw. Vers. Sta., 96 (1920), No. 5–6, pp. 209–262, pls. 3*).—Continuing work previously noted (E. S. R., 44, p. 421), studies on the conditions in soils under which difficultly soluble phosphates may be utilized by crops are reported.

The experiments were conducted with corn and mustard, and the assimilation of the phosphoric acid of raw phosphates determined from soils of neutral, alkaline, and mineral and organic acid reaction. It was found that corn utilized the difficultly soluble phosphates only in the presence of an acid reaction of the soil, which condition could be produced by fertilization with physiologically acid reacting fertilizers. The addition of lime destroyed the acid reaction and inhibited the assimilation of phosphoric acid.

The mustard was able to assimilate unavailable phosphates in the presence of a more alkaline soil reaction than the corn. Mustard was found to be relatively independent of soil reaction or lime additions in this respect, as long as the reaction was not so strong as to become toxic. Corn assimilated lime and phosphoric acid in the ratio of 3 molecules of calcium oxid to 1 molecule of phosphoric acid. Mustard assimilated these materials in the ratio of about 15:1. The lime-phosphoric acid factor was found to limit the ability of the plant to utilize phosphoric acid and to produce a change in the reaction of an originally neutral soil after the growth is ended.

The process of making plant nutrients soluble in soils was found to depend mainly upon the variable assimilation of anions and cations, this resulting in variations in the soil reaction.

Proper nitrogen fertilization was of special importance because, in addition to increasing the plant food, the soil reaction could be regulated.

Free citric acid was decomposed in soils within a few days, but carbon dioxid appeared to be of importance in solution and decomposition processes in soils.

The lime requirement of the soil as influenced by long continued use of commercial fertilizers, J. W. White (*Pennsylvania Sta. Rpt. 1917, pp. 89–105*).—Studies on the lime requirement of a residual limestone soil of the

Hagerstown series which has been subjected to continuous treatment with commercial fertilizers since 1882 are reported.

The change in the lime requirement over a period of five years was especially studied. It was found that on all plats of from moderate to marked acidity the lime requirement increased quite rapidly during the 5-year period. In the case of plats treated with sodium nitrate there was a marked increase of lime requirement. Plats treated with dried blood showed a slightly higher average lime requirement than the plats treated with sodium nitrate, and plats treated with ammonium sulphate showed an average lime requirement over twice as great as that shown by plats treated with dried blood. The marked variations in the lime requirements of four tiers of similar plats indicated that an average lime requirement does not bear any definite relation to the individual plat. It is considered doubtful whether or not the acidity of plats treated with manure, sodium nitrate, phosphoric acid, or potash is due to the residual effect of the material applied, as is the case of plats treated with ammonium sulphate. It was found that on all plats where the lime requirement is over 2,000 lbs. per acre the proportion of clover to timothy is decreasing.

Further experiments on the lime requirement of soils treated with various fertilizers in the absence of plant growth indicated that the lime requirement of the soil is not materially affected by the fertilizer materials applied, with the exception of ammonium sulphate, horn meal, and dried blood. Acid phosphate and potassium chlorid increased the lime requirement very little, while basic slag, rock phosphate, and ground bone reduced the lime requirement. Sodium nitrate caused some increase in lime requirement, as did also cottonseed meal in two cases. It is concluded that nitrogenous fertilizers capable of rapid nitrification and which do not contain appreciable amounts of basic ash constituents will materially increase the lime requirement of the soil.

On the disappearance of soil nitrogen, W. B. Ellett (*Virginia Sta. Rpt. 1919, pp. 26–28*).—Studies conducted to determine the effect of applications of burned lime on the nitrogen content of Hagerstown loam soil showed that the burned lime applied at the rate of 1,200 lbs. per acre did not deplete the native soil nitrogen.

It was found that the lime made conditions more favorable for corn and larger yields were produced, with a heavier draft on the soil for nitrogen, potash, and phosphoric acid. This is attributed to the improvement of the physical condition of the soil.

Velocity of nonsymbiotic nitrogen fixation in soils of the general fertilizer series, G. C. Given, G. J. Kuhlman, Jr., and C. A. Kern (*Pennsylvania Sta. Rpt. 1917, pp. 405–409*).—Studies on the rates of nonsymbiotic nitrogen fixation in well-drained clay loam or silty clay loam soils of the general fertilizer series at the station are reported. The same soils were used as were previously examined as to ammonifying and nitrifying powers (E. S. R., 43, p. 515). The relative positions of the plats studied with reference to nitrogen fixation were found to be remarkably similar to their relative positions in crop-producing power in the cases of hay, oats, and wheat.

In a second series of studies the investigation was extended to cover several other plats of known treatments and yields. This series, however, did not show the distinct correlation between the nitrogen fixation and productivity that was observed in the earlier study. The opinion is expressed, however, that the correlations observed in the first series are too numerous to be due to mere coincidence. A more detailed study is considered necessary.

Effect of nitrogen applications at different periods of growth of cereals (*California Sta. Rpt. 1920, p. 65*).—Pot culture experiments by W. F. Gericke

on the effect of equal amounts of soluble nitrogen applied at different phases of growth of spring wheat, winter wheat, oats, and rye showed that marked increases in both straw and grain were obtained, especially with spring wheat when sodium nitrate and ammonium sulphate were applied subsequent to the planting of the seed. The maximum yield was obtained when the nitrogen was added from four to nine weeks after the planting. Rye was similarly affected but not so much as spring wheat. Oats was the least influenced by the time of application of nitrogen.

Tests with calcium cyanamid, ANTONIADIS and MAUME (*Ann. École Natl. Agr. Montpellier, n. ser., 17 (1919), No. 2, pp. 120–130, figs. 12*).—Pot experiments with clover on light calcareous sandy soil to compare the fertilizing action of calcium cyanamid with that of ammonium sulphate and chlorid, when added at the time of seeding and 15 days before seeding, showed that the cyanamid was definitely toxic when incorporated with the soil with the seed. It was not toxic when incorporated 15 days before seeding, but had no marked fertilizing influence. The experiments are being continued on different types of soil.

Potash resources of Nebraska, W. B. HICKS (*U. S. Geol. Survey Bul. 715–I (1921), pp. [2]+125–139, fig. 1*).—This bulletin presents data on the amount, distribution, composition, and origin of the potash brines of Nebraska.

It is stated that there are more than 100 known productive lakes in the State, scattered over an area of some 800 square miles and covering an aggregate area of more than 6,097 acres. In addition, there are a number of reported productive lakes about which little is known but which cover about 2,000 acres. The known productive lakes are estimated to contain a total of 941,215 short tons of solids, representing about 215,110 short tons of potash. About one-third of the potash in the productive lakes is said to be represented by brines containing 10 per cent or more of solids, nearly half by brines containing from 5 to 10 per cent of solids, and less than one-fourth by brines containing from 1 to 5 per cent of solids. The unknown lakes are estimated to contain about 50,000 tons of potash.

The commercial potash brines vary much in salinity and in the composition of the dissolved salts, which consist of carbonates, bicarbonates, sulphates, and chlorids of sodium and potassium in varying proportion. Carbonates usually predominate, bicarbonates are high, and sulphates are variable but often high.

It is stated that the geologic history of the State precludes any deep-seated origin of the potash brines in the sand hills. The view is expressed that only small quantities of potash are being leached from the sand hills, and that no large potash reserves are likely to be found in regions not occupied by lakes.

A bibliography is included.

Composition of end liquor lime, J. GÖRBING (*Ztschr. Öffentl. Chem., 26 (1920), No. 18, pp. 205–213, figs. 3*).—An analytical study is reported of lime fertilizers prepared by sprinkling burned lime with potash end liquors containing about 30 per cent of magnesium chlorid. These products are of complicated composition and are not merely mixtures of calcium hydroxid and magnesium chlorid with traces of magnesium hydroxid and calcium chlorid.

Analyses of an average sample showed a content of water of 30.41 per cent, calcium oxid 27.49, magnesium oxid 11.37, potash 0.58, and chlorin 11.87 per cent, with varying percentages of other constituents. Analyses of hard lumps showed the presence of water 31.86 per cent, calcium oxid 36.63, magnesium oxid 5.91, chlorin 4.89, and carbon dioxid 1.85 per cent.

A sample of the fertilizer treated with water on a filter gave a solution containing calcium oxid 15.12 per cent, chlorin 11.75, potash 0.6, and only traces of magnesium oxid. This is taken to indicate the complete transformation of the magnesium chlorid to compounds insoluble in water. The residue contained calcium oxid 12.4 and magnesium oxid 11.4 per cent, and was of a light pulverulent nature. This condition was also produced with material exposed in the open for about six months.

It is concluded that the magnesia in these fertilizers is in very finely divided form and is inclosed by calcium chlorid until liberated by the action of the atmosphere. When freed it is in suitable form for distribution throughout the soil.

Carbon dioxid and plant growth, Bornemann (*Mitt. Deut. Landw. Gesell., 35 (1920), No. 51, pp. 693–695, figs. 5*).—Experiments on the fertilization of peas, oats, barley, potatoes, onions, and kohl-rabi with carbon dioxid gas on loess loam soil well supplied with lime are reported.

The gas was injected at the rate of about 42 liters per square meter of surface (approximately 1 gal. per square foot) per day of 10 hours. All the crop yields were increased by treatment with carbon dioxid. The total weight of the pea crop was increased 44 per cent and the grain weight 47 per cent. The oats crop was increased almost 69 per cent and the potato crop 42.6 per cent. There was also an increase in the starch content of the potatoes. No conclusions are drawn.

Millions from waste, F. A. Talbot (*Philadelphia: J. B. Lippincott Co.; London: T. Fisher Unwin, Ltd., 1920, pp. 308*).—This is a semipopular review, written from the English viewpoint, indicating certain of the most obvious channels through which wealth is being permitted to escape and discussing some of the more ingenious efforts which are being made to prevent such wastage. Among other wastes of industrial importance, special attention is drawn to the potential supplies of fertilizer in such wastes as slaughterhouse refuse, by-products of the iron and steel industry, sewage sludge, and military organic wastes. Another waste discussed of more or less agricultural importance is the liquid fuel lost in coal.

Report on commercial fertilizers, 1920, E. H. Jenkins and E. M. Bailey (*Connecticut State Sta. Bul. 223 (1920), pp. 3–66*).—This bulletin contains a list of brands of commercial fertilizers registered for sale in Connecticut during 1920, and also actual and guarantied analyses of 625 samples of fertilizers and fertilizer materials collected for inspection in the State during the year.

Report of analyses of commercial fertilizers (*La. Dept. Agr. and Immigr. Fert. Rpt., 1919–20, pp. 72*).—This bulletin contains the results of actual and guarantied analyses of 2,095 samples of fertilizers and fertilizer materials collected for inspection in Louisiana for the year 1919–20.

AGRICULTURAL BOTANY.

Plant breeding (*California Sta. Rpt. 1920, pp. 63, 64*).—E. B. Babcock and J. L. Collins report on their heredity studies in Crepis that they have found that selection in the naturally cross- and self-fertilized composite species, *C. virens*, has resulted in the isolation of several varieties which under experimental conditions remain true to type. Inter-specific crosses between *C. virens*, a six-chromosome species, and *C. tectorum*, an eight-chromosome species, have been made. The F_1 hybrid of the plant of this generation grew with great vigor through the cotyledon stage, after which it ceased to grow. It remained alive for 20 to 80 days, but always died without further development.

W. A. Setchell, T. H. Goodspeed, and R. E. Clausen have given the results of 10 years' study of inheritance in *Nicotiana tabacum*, demonstrating the existence of six pairs of Mendelian factors and the mode of their inheritance. Flower color, flower shape, leaf base type, and flower size are considered in the study.

H. B. Frost has given a brief report of a statistical and analytical study on the inheritance of doubleness in Matthiola. The results seem to be consistent with a balanced-factor hypothesis which has been worked out for this case.

Inheritance of sugar and starch characters in corn, R. A. HARPER (*Bul. Torrey Bot. Club, 47 (1920), No. 4, pp. 137–186, pls. 3*).—Evidence obtained in a study of four generations of a cross between a sweet and a dent corn is considered to show that what can be interpreted as a separation of the parental germ plasms in the reduction divisions and recommendations of the gametes so produced according to the laws of chance, actually occurs as assumed generally in Mendelian conceptions. It appears equally certain that provision must be made in such theoretical conceptions for the occurrence of intermediates. There is evidence of segregation (chromosome reduction) but not of the so-called purity of the gametes. The bearings of the observed facts are discussed.

Inheritance of aleurone color in maize, M. C. COULTER (*Bot. Gaz., 69 (1920), No. 5, pp. 407–425*).—The author, having undertaken an investigation testing the dependability of some of the classic experiments with corn, outlines the technique employed, with suggestions.

Microsporogenesis in Datura stramonium, C. E. O'NEAL (*Bul. Torrey Bot. Club, 47 (1920), No. 6, pp. 231–241, pls. 2*).—A study is detailed as carried out with *D. stramonium*, which is said to be suitable for cytological investigation as well as for studies of Mendelian behavior. It is stated that no phyical basis for the Mendelian characters considered can be found in the chromosomes, nor is any cause found for the occurrence of mutants.

The localization of hereditary substances in plant cells, G. TISCHLER (*Biol. Zentbl., 40 (1920), No. 1, pp. 15–28*).—A bibliographical review and brief study led to the disapproval of the use of the term hereditary elements as not sufficiently precise. Certain terms and hypotheses are discussed.

Mendelian splitting and chemical equilibrium, O. RENNER (*Biol. Zentbl., 40 (1920), No. 6, pp. 268–277*).—The author undertakes to refer Mendelian splitting to chemical characters and behavior.

Criticism of Renner's contribution on Mendelian splitting and chemical equilibrium, E. LEHMANN (*Biol. Zentbl., 40 (1920), No. 6, pp. 277–288, figs. 2*).—A review of the paper by Renner above noted is given, together with a bibliography of the subject.

Plant physiology (*California Sta. Rpt. 1920, pp. 65, 66*).—H. S. Reed, studying the dynamics of the growth process, has shown that the rate of growth in plants is definite and conforms to equations expressing unimolecular reactions. He has also reported upon growth and sap concentration, showing that as growth begins in the spring there is a rapid fall in concentration of the sap. During the summer the concentration gradually rises. The sap of rapidly growing trees is said to be more dilute than that of slower-growing trees of the same variety. Higher sap concentration and slower growth appear to be associated with the production of fruit buds. Sap concentration of the leaves is said to be more constant than that of the stems.

A. R. Davis, following up the work of Waynick (E. S. R., 42, p. 819), has found that, in studies of the rôle of variability in determining the efficiency of plant culture solutions, it is inadvisable to attach significance to small differences in arithmetic means when few plants are considered and the extent of variability is unknown. His experiments are said to indicate that there is no "best" solu-

tion in the sense of Shive, but that when variation is considered, the comparison of a number of favorable solutions will reveal no significant differences.

W. F. Gericke, investigating the question of whether plants produce growth-inhibiting and growth-stimulating substances, obtained evidence that seems to indicate that these substances may be produced by plants and can affect the plant's growth. In studies on the effect of temperature on the physiological balance of nutrient solutions, he tested 126 nutrient solutions at seven different maintained temperatures, or 882 different growth complexes. Temperature was shown to affect the physiological balance of the nutrient solutions.

Auxographic measurement of swelling of biocolloids and of plants, D. T. MacDougal (*Bot. Gaz., 70 (1920), No. 2, pp. 126–136, figs. 2*).—The chief purpose of this article is to describe the methods which have been used in the study of colloidal preparations, the reactions of which might furnish a physical basis for the interpretation of growth in plants, and to recapitulate some of the features of swelling of these substances which are as yet undescribed or but little known.

The methods of preparation and measurement of swelling of colloids described are said to confirm and extend knowledge as regards the behavior of agar, albumin, gelatin, and mucilages, and to fix upon pentosan-protein mixtures as artificial preparations which swell in a manner similar to cell masses of plants. The use of the auxograph has made it possible to compare the nature, extent, and duration of these changes with variations in volume of growing cell masses.

The casting and desiccation of colloidal plates in such manner that shrinkage and swelling takes place unequally in different axes, and the measurement of such differential swelling, also furnishes evidence which may be of value in interpreting changes, as in form, of the special bodies of the protoplast which accompany and mark the morphological crises of the cell.

The physical factors in the growth of the tomato, D. T. MacDougal (*Bul. Torrey Bot. Club, 47 (1920), No. 6, pp. 261–269*).—While the tissues of animals and most plants accumulate carbohydrates, proteins, salts, and other solids during growth, so that relative dry weight increases progressively from early to later stages, it is found that leaves and stems of succulents and such fruits as that of tomato (Lycopersicum) reverse this relation and that the same is probably true of such plants as melons and mushrooms. The rate of increase in diameter of such globose, berry-like fruits as that of tomato is not even an approximate measure of actual growth, considered as an accretion of water and solid material.

Discussion is given of the internal factors which determine the rate and amount of growth of the tomato, including soluble sugars and salts or bases, all these increasing toward maturity, and the albumins and celluloses, which decrease with development. The various facts cited support the conclusion that the distentive force in growth of young fruits is chiefly imbibition, osmotic action playing possibly a more important part in later stages.

The growth of a fruit is therefore a resultant of two groups of activities, one ordinarily classed as imbibitional and the other associated with osmosis and turgidity. Mature tomato plants represent a type of plant structure showing a loss of dry weight with age, ranging from 1 to 4 per cent.

Continuous measurements of tomato fruits reveal slackened growth or shrinkage in the midday period corresponding to the time of the most active transpiration. It is concluded that water absorption during this period is balanced by the loss from the surface in accordance with the behavior of many other structures, such as trunks and twigs of trees, stems of sunflowers, joints of Opuntia, and leaves of Mesembryanthemum.

Statocytes of the wheat haulm, T. L. Prankerd (*Bot. Gaz., 70 (1920), No. 2, pp. 148–152, figs. 4*).—Further observations (E. S. R., 36, p. 729) on the cells containing statoliths show that the wheat haulm possesses two types of such cells, occurring only in the nodes. The smaller contains movable starch grains and the larger one movable crystal of calcium oxalate. It is suggested that the nodes of wheat are definite sense organs, showing a high degree of evolutionary development.

Cytological observations on Hedera helix and Solanum tuberosum, J. Pujiula (*Broteria, Ser. Bot., 17 (1919), No. 2, pp. 67–96, pl. 1, figs. 17*).—An account with bibliography is given of a study, as regards technique (including special stains), and observations of living and prepared materials from *H. helix* and *S. tuberosum* for the purpose of demonstration of various cytological elements, the characters and significance of which are briefly discussed.

Relation of flax to varying amounts of light, J. Adams (*Bot. Gaz., 70 (1920), No. 2, pp. 153–156*).—Tests made on shaded and on unshaded flax (*Linum usitatissimum*) show that as regards average height, weight, and number of capsules produced the unshaded plants give a higher average under the conditions employed.

Effect of unilateral monochromatic light and group orientation on the polarity of germinating Fucus spores, A. M. Hurd (*Bot. Gaz., 70 (1920), No. 1, pp. 25–50, figs. 2*).—Concluding an account of technique and results in the study here presented, the author states that the effective wave lengths in the establishment of the polarity of Fucus spores, the result of whose use for unilateral illumination is the same as that produced by white light, are, with the intensity of strong diffused daylight, the shorter rays of the blue end of the spectrum of approximately 4,000 to 5,600 Ångstrom units. There is some evidence that ultraviolet light can produce the same effect.

Temperature and rate of moisture intake in seeds, C. A. Shull (*Bot. Gaz., 69 (1920), No. 5, pp. 361–390, figs. 4*).—This paper deals with the quantitative influence of temperature on the rapidity of moisture intake by certain seeds chosen for the presence and absence of semipermeable coats. *Xanthium pennsylvanicum* and commercial and garden peas were used, the latter with the coats removed.

The curves of water intake were found to be complex, but capable of representation by a logarithmic equation or series of equations indicated. The analysis of the data submitted does not support the theory of Brown and Worley (E. S. R., 28, p. 226) that the velocity of intake is an exponential function of the temperature, the velocity of intake at any given moment in the seeds studied being approximately an inverse exponential function of the amount of water previously absorbed. It is believed that absorption at different temperatures involves both physical and chemical changes. The main chemical changes with rise of temperature are believed to occur in the colloids of the seed, and semipermeability, as such, is thought not to be an important factor in determining the rate of water absorption.

The paper considers critically the methods and interpretation of the similar work of Brown and Worley on seeds of Hordeum.

Measurement of the amount of water that seeds cause to become unfree and their water-soluble material, G. J. Bouyoucos and M. M. McCool (*Jour. Agr. Research [U. S.], 20 (1921), No. 7, pp. 587–593*).—In a previous publication (E. S. R., 36, p. 719) the senior author gave an account of the investigations on the unfree water occurring in soils. In the present paper, which is a contribution from the Michigan Experiment Station, the occurrence of unfree water in seeds is described. By the term "unfree water" the authors refer

to the water taken up by soils, seeds, etc., that undergoes changes resulting in its inability to freeze even when subjected to temperatures from −1.5 to −78° C. Seeds of a dozen or more crops were tested in the dilatometer described in the article referred to above, and the amount of unfree water determined. This was found to vary widely, the amount of unfree water in broom corn being 25.05 per cent and black soy beans 76.76 per cent, based on the air-dry weight of seeds. Repeated freezing and thawing is said to tend to diminish considerably the amount of unfree water, especially in some varieties of seeds. Dry seeds, which contain a large amount of water-soluble material, are characterized by the high freezing-point depression.

Studies in evaporation and transpiration, G. F. FREEMAN (*Bot. Gaz.*, *70* (*1920*), *No. 3*, *pp. 190–210*, *figs. 5*).—As a result of evaporation experiments carried out by means of a porous cup atmometer inclosed in a glass cylinder of 1 liter capacity, through which an air current is passed, an evaporation formula is offered which may take the form of $y=z(t-t_1)$ or either of two more complex formulas. In this, y signifies rise in the dewpoint of the air caused by the loss of water to it of a given evaporating surface, t = temperature of the air, t_1= dewpoint of the outside air, and z= a constant used when the area and wind movement remain constant. The formula proposed appears to be general in type and capable of use in any situation where y is measurable.

Under temperature changes only, alfalfa leaves appear to act as physical evaporating surfaces. Changes in the dewpoint of the air result in profound changes in evaporating efficiency of leaf surfaces. This is thought to be a result of the opening and closing of the stomata. Distinct pure races of alfalfa exhibit measurable differences in the rate of evaporation per unit area of their leaves. Such differences may be of economic value in semiarid or irrigated regions where production depends principally upon the efficiency of the use of the available water supply.

Concentration of potassium in orthoclase solutions not a measure of its availability to wheat seedlings, J. F. BREAZEALE and L. J. BRIGGS (*Jour. Agr. Research* [*U. S.*], *20* (*1921*), *No. 8*, *pp. 615–621*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the authors describe experiments conducted to determine the availability of the potassium in solution of orthoclase by growing wheat seedlings in the solution, analyzing the seedlings for potassium, and comparing the results with those obtained from suitable controls. The results are said to show that potassium present in solutions of orthoclase is not appreciably absorbed by young wheat plants, and the conclusion is reached that potassium may be present in soil solutions in such combinations with other elements that it is not available to plants.

Residual effects of carbon dioxid gas additions to soil on roots of Lactuca sativa, H. A. NOYES and J. H. WEGHORST (*Bot. Gaz.*, *69* (*1920*), *No. 4*, *pp. 332–336*, *figs. 5*).—Results obtained in the study of garden plants previously employed (E. S. R., 40, p. 820) confirmed the conclusions of that study to the effect that the carbon dioxid content of garden soils is sometimes detrimental to the root development of some of the plants growing in the garden. It is thought possible that the data may help in explaining odd tropic phenomena or may throw some light on what is known as soil toxicity.

Internal stomata in ericaceous and other unrelated fruits, H. F. BERGMAN (*Bul. Torrey Bot. Club*, *47* (*1920*), *No. 5*, *pp. 213–221*, *figs. 9*).—An account is given of observations involving the presence and associations of stomata internal to certain fruits, with a discussion of the probable origin and bearings of this habit. A connection is suggested between this habit and gas exchange in plants having thickened or heavily cuticularized epidermis.

Petiolar glands in the plum, M. J. Dorsey and F. Weiss (*Bot. Gaz.*, *69* (*1920*), *No. 5*, *pp. 391–406*, *pls. 2*).—Examination of over 80,000 leaves representing 15 species and interspecific hybrids of the plum is said to show that two glands typically occur on the petiole, or less frequently on the leaf base. The glands in these two positions, taken on the basis of vascular connections, present different orders of structure, which are discussed with their supposed morphological significance.

Hawaii's tapestry forests, V. MacCaughey (*Bot. Gaz.*, *70* (*1920*), *No. 2*, *pp. 137–147*, *figs. 6*).—The descriptive account here given relates chiefly to the portions and species (of which lists are given) of the Hawaiian rain forest that cling to certain very steep slopes in localities indicated, and to the related processes.

Nodule bacteria of leguminous plants, F. Löhnis and R. Hansen (*Jour. Agr. Research* [*U. S.*], *20* (*1921*), *No. 7*, *pp. 543–556*, *pls. 2*).—This is an account of cooperative investigations carried on by the Bureau of Plant Industry, U. S. Department of Agriculture, and the Illinois Experiment Station on the morphology and physiology of the nodule bacteria of leguminous plants. Particular attention is given to the organism commonly recognized as being connected with nitrogen fixation and *Bacillus radiobacter*, a widely distributed organism frequently associated or confused with the nodule bacteria.

As a result of their investigations the authors claim the nodule bacteria of leguminous plants may be divided into two groups which differ morphologically and physiologically. The first group shows all the characteristics of *B. radicicola*. It is peritrichic, grows relatively fast on agar plates, and changes the milk in a very characteristic manner. It produces nodules on the roots of clover, sweet clover, alfalfa, vetch, pea, navy bean, lupine, black locust, Amorpha, and Strophostyles. The second group is characterized by monotrichic flagellation and is of comparatively slow growth on agar plates. It has been isolated from cowpea, soy bean, peanut, beggarweed, Acacia, Genista, and Cassia. This second group, the authors state, would ordinarily be considered as a new species, but for the present they prefer to consider the two as different types of growth of the same organism. According to their investigations the name of the first organism should be *B. radicicola* and not Rhizobium or Pseudomonas.

B. radiobacter is said to be regularly present in the root nodules of leguminous plants, where it stimulates the development and activity of the nodule bacteria. On account of its similarity to *B. radicicola*, it has been repeatedly mistaken for the nodule organism in the cowpea-soy bean group. It is claimed that *B. radiobacter* can be easily differentiated from *B. radicicola* by its brown growth on potato.

Report of committee on descriptive chart, II, H. J. Conn et al. (*Jour. Bact.*, *5* (*1920*), *No. 3*, *pp. 315–319*).—In 1917 the committee on the descriptive chart of the Society of American Bacteriologists presented a report recommending a new chart in the form of a folder, also an outline of methods (E. S. R., 39, p. 828) designed to accompany the chart. The society decided to print and distribute the chart for practical test before asking for its adoption officially. The demand for the new chart is considered to show that it is generally preferred to the old chart, though admittedly still in need of revision. Besides various matters of detail, three fundamental questions that have been raised relate to the proper size of the chart (two or four pages), to the continued use of the group number, and to the reservation of a special space for pathogenesis. These three questions are briefly discussed.

Report of committee on descriptive chart, III, K. N. Atkins (*Jour. Bact.*, *5* (*1920*), *No. 3*, *pp. 321–324*).—Details of a proposed modification of the Gram stain are briefly noted with discussion.

FIELD CROPS.

[Work with] farm crops (*California Sta. Rpt. 1920, pp. 52–57, 89*).—Work with cereals, sorghums, legumes, and flax, and irrigation and pasture experiments, conducted in continuation of those already noted (E. S. R., 42, p. 822), are described.

Improved California No. 4000 barley, a pure-line selection of common barley, led in tests made by B. A. Madson and G. W. Hendry with a six-year average acre yield of 94.75 bu. It is adapted to the same general conditions as common barley, but Tennessee Winter, which averaged 91.5 bu. during the same period, is considered better suited to heavy soil or soils inclined to be excessively wet during the rainy season. The latter is said to be almost wholly immune to leaf stripe (*Rhyncosporium* sp.), which seriously damages or almost wholly destroys such barleys as common, Beldi, and particularly Mariout. Tests by J. W. Gilmore and Hendry of new varieties of cereals, legumes, grasses, and miscellaneous crops, selection of barleys resistant to shattering, head-to-row tests of wheat, and head-to-plat plantings of milo are also noted.

Results of flax experiments reported by Hendry demonstrate that with proper cultural methods and suitable varieties profitable yields of flaxseed may be produced on Sacramento Valley grain lands without irrigation. Yields of 13.2 bu. per acre have been obtained. The best results were secured by drilling from 30 to 40 lbs. of seed per acre in February on fall-plowed land.

In studies by Hendry and F. W. Woll to determine the factors influencing the yield, quality, and feeding value of cereal hays, the results showed the varieties to rank in the order of quality of hay, from finest to coarsest, as follows: Wheats, Club, Velvet Don, Sonora, Baart, and White Australian; oats, wild oats, red, black, and Roberts; and barley, Chevalier, Coast, and Nepaul. When wheat hay cut in blossom, milk, dough, and ripe stages was subjected to a palatability test, the stock ate all of the blossom hay before starting on the milk, all of the milk before the dough, and ate the ripe hay last. The following number of days elapsed from planting to the soft-dough stage: Barley, Coast 174, Chevalier 177, and Nepaul 177; rye, 187; wheat, Baart 190, Sonora 192, Club 194, White Australian 194, Velvet Don (durum) 202; oats, red 202, wild 202, black 211, and Roberts 226.

The Honey variety of sweet sorghum proved particularly valuable for forage in the Sacramento and San Joaquin Valleys, where the growing season is too short for late maturing types.

Observations reported by Gilmore and Hendry showed milo, after barley without irrigation, to make a 5-year average acre yield of 45.3 bu., indicating the possibility of producing profitable milo yields under these conditions. In general, milo exercised no beneficial effect upon succeeding wheat crops, as wheat after wheat gave a 5-year average acre yield of 29.4 bu., while wheat after milo averaged but 25.6 bu. for the same period. During the five seasons wheat after fallow averaged 38.2 bu. per acre, indicating that milo preceding wheat did not function as a fallow in its effect upon yield.

Notes on sheep tansy (*Phacelia tanacetifolia*) show it to be a hardy, vigorous winter grower, drought resistant, and to seed freely. While eaten readily by sheep and cattle, it is succulent and unsuited for hay. The abundant production of nectar-secreting flowers, remaining in blossom for about 30 to 40 days, recommends its culture as a bee forage.

In tests of alfalfa varieties, Hairy Peruvian gave the best results as to yield and maintained better pasturage during the winter months. Trials of dry-land beans at Riverside and rice-irrigation studies near Norman are also noted, and analyses of oriental beans by M. E. Jaffa are included.

[Report of field crops work in Minnesota, 1919], A. Boss and E. M. Freeman (*Minnesota Sta. Rpt. 1920, pp. 35, 36, 54*).—Varietal, cultural, and breeding experiments with cereal, forage, and other field crops conducted during the year ended June 30, 1920, in continuation of work already noted (E. S. R., 42, p. 824), are described.

Several grades of wheat were sown on land of medium and low productivity, at varied rates, so as to secure approximately the same number of seeds or the same number of pounds per acre. No significant differences in yield resulted. The heavier grades of oats appeared to be of advantage on land of low productivity. Winter rye and wheat seeded early in September appeared to give results superior to seedings made early in October.

Leaders in variety trials were as follows: Spring wheat, Ghirka, Preston, and Stanley A; winter wheat, Minturki, Minhardi, Malakoff, and Buffums No. 17; rye, Swedish, Minnesota No. 2, Wisconsin Pedigree, and Rosen; oats, Gold Rain, Irish Victor, Silvermine, Garton selections, and Iowa No. 103; barley, Improved Manchuria, Minnesota 184, and Akers Russian; field beans, M. A. C. Robust and Black Turtle Soup; and soy beans, Chestnut, Ito San, Accession No. 182, Pedigree 1, Minsoy, and Soysota.

Both thorough cultivation in a cultivated crop and bare fallow from July 1 to September 1 have cleaned fields of sow thistle. Frequent hoeing during July and August is recommended for small areas that can not be well handled otherwise. Covering with straw to a depth of from 14 to 18 in. proved very satisfactory, while covering with tar paper or spraying with either sodium arsenite or fuel oil were found to be expensive.

[Report of field crops work in Virginia, 1919] (*Virginia Sta. Rpt. 1919, pp. 12–15, 16, 17, 18*).—The progress of work with field crops conducted on the station and the county experiment farms is described as heretofore (E. S. R., 42, p. 436).

Outstanding cereal varieties included Silver King corn (for the mountainous regions), wheat selections Nos. 112 and 131, winter oat selection No. 1, Giant Winter rye for grain, and Abruzzi rye for winter pasture, and Union and Tennessee Winter barleys. Spring barleys did not prove suited to the section.

Cowpeas and velvet beans have not given satisfaction in the high altitude of southwest Virginia, and sorghums failed to produce good results at the station. Hollybrook was the leading variety of soy beans for both grain and pasture in the tests. The best results with alfalfa were secured in seedings made August 1 at the rate of 20 lbs. of seed per acre.

[Field crops] work on the Huntley [Mont.] Reclamation Project Experiment Farm in 1919, D. Hansen (*U. S. Dept. Agr., Dept. Circ. 147 (1921), pp. 7–11, fig. 1*).—Experiments with field crops conducted in 1919, in continuation of earlier work (E. S. R., 43, p. 435), are described.

Results covering a period of eight years of crop-rotation experiments indicated that alfalfa seeded in the fall in grain stubble gave higher yields than when seeded the following spring, and that the highest yield occurred the second year after planting. The maximum yield with potatoes, an average of 310.6 bu. per acre, was secured in a 2-year rotation of oats and potatoes in which manure was applied preceding the potatoes. When following oats without manure potatoes made an average of only 249.3 bu. Sugar beets gave highest average yields, 11.17 tons per acre, in rotations in which beets followed potatoes. Beets following oats and manure yielded 11.08 tons, while beets following oats without manure gave but 9.2 tons per acre.

Northwestern Dent corn made average acre yields of 9.74 tons of silage and as in tests conducted previously outyielded other early-maturing varieties of corn. As in 1918, in tests of sunflowers for silage, the highest acre yield, 29.75

tons, together with the better quality of silage, was obtained from rows 20 in. apart.

[Report of field crops work in Burma, 1919 and 1920], D. F. CHALMERS and C. R. P. COOPER (*Burma Dept. Agr. Rpts. 1919, pp. 2–9, 10, 11, 13; 1920, pp. 3–8, 9*).—The progress of work conducted during the years ended June 30, 1919, and 1920, along the same general lines as previously noted (E. S. R., 41, p. 528), including variety, cultural, and fertilizer tests with rice, sesame, wheat, peanuts, beans, sugar cane, tobacco, cotton, fiber crops, and miscellaneous forage crops, is briefly outlined.

The recognition and yields of red clover from different sources in experiments in 1913–1915, K. MÜLLER (*Landw. Jahrb., 50 (1916), No. 2, pp. 303–353, fig. 1*).—Experiments to determine the agricultural value of red clover from different regions in Europe, including central, western, and southern France, Italy, the Black Forest, the Palatinate, Styria, and western Russia, as conducted in six districts of different soil and climatic conditions in Baden, Germany, are described. The seeds were obtained from commercial sources and gave high percentages of germination.

As a rule a high weight per 1,000 seed was correlated with high yields. This weight varied with the different varieties, and it is suggested that with seeds of the same age this weight might be used to determine the origin. The size of seed may also be used for this purpose, especially in years showing great climatic variations in the different European countries.

The study of weed seeds in different clover crops gave no basis for the claim made by seedsmen that typical weeds become acclimated in the course of years in other than their native countries and consequently are of small value in determining the source of clover seed. Seeds of characteristic weeds were found only in those sorts where found 15 years previously. Even when acquired accidentally in the plats the second cutting of the clover matured before the extraneous seed ripened.

Characteristic weed seed of southern European varieties included *Arthrolobium* sp., *Torilis nodosa*, *Helminthia echioides*, etc. The last two are also found in red clover from western France (Poitou), but do not occur in the mountain clover of central France, known commercially as "north French" red clover.

The German types produced best, the highest yields coming from the variety from the Palatinate, which is considered well adapted for permanent meadows. Although seed of this variety contained nearly 2.5 per cent of buckhorn plantain seed, the plats were entirely weed free. Average acre yields of green forage per single cutting from the different varieties in all of the trials from 1913 to 1915, inclusive, were as follows: Palatinate, 20,239 lbs.; Black Forest, 20,051 lbs.; Styria, 18,886 lbs.; western France, 18,404 lbs.; northern France, 17,542 lbs.; Russia, 17,497 lbs.; southern France, 16,323 lbs.; and Italy, 13,092 lbs. The plats of southern European seed were very weedy, and the net yields of forage were not more than half those of the middle European.

Varieties from central and western France yielded well even in the coldest districts in the first harvest year, and are recommended for 1-year plantings. Ordinarily these varieties are difficult to distinguish from the unadapted clovers of southern Europe, but the presence of Arthrolobium seed characterizes the latter. The author urges that the French varieties be grouped according to climatic regions rather than geographical districts in order to determine exactly which are adapted for German use. This would facilitate the division between central France varieties and southern European varieties.

Notwithstanding hard frosts the southern European varieties did not winter kill, as is generally supposed, but were killed off by attacks of *Glœosporium*

caulivorum and *Sclerotinia trifoliorum*. Experiments failed to show a correlation between winter resistance and the dry matter of clover varieties immediately before a frost.

A brachytic variation in maize, J. H. KEMPTON (*U. S. Dept. Agr. Bul. 925* (*1921*), *pp. 28, pls. 19, figs. 8*).—The maize variation under consideration has been noted heretofore (E. S. R., 44, p. 25). The inheritance of this and other brachytic variations, inheritance of brachysm in hybrids with commercial varieties, the morphological significance and associated changes involved, and the agricultural advantages of the type are discussed in detail.

The reduction in stature produces a plant which is considered admirably adapted to dry-land and irrigation culture, and, while the yield as compared with the varieties of the corn belt is low, the reduced stature, sturdy erectness, and increased root development offer advantages for extreme conditions which may outweigh consideration of yield.

Brachytic stature apparently reappears uncontaminated in the perjugate generations of hybrids with varieties of normal height. One of the two teratological forms arising in the hybrids between brachytic and normal plants, a new variation designated as "adherence," appeared in the perjugate generation of the brachytic-Boone hybrid. The upper leaves of the plant adhered as if glued, and the branches of the tassel were compacted into a hardened mass, which, in expanding, burst through the confining blades and sheath. In instances where the ear-bearing node was involved the ear also was contorted. This seems to be completely associated with normal stature and offers no obstacle to securing the combination of high yield and short stature. In the other variation, relatively common in many nonbrachytic strains, the ears terminated in staminate spikes, which were undesirable as they developed at the expense of the pistillate portion to a certain extent. It also appeared to be associated with stature, indicating that the genes for these characters are located in the same chromosome.

"The close relation of ears terminating in staminate spikes to ears borne as basal branches of the terminal inflorescence is indicated in a hybrid between brachytic and Hopi. The evidence from this hybrid suggests that the ear of maize may have developed from the basal branches of the terminal panicle rather than from the central spike of the terminal inflorescence of a lateral branch of the main culm."

Cotton culture in the San Joaquin Valley in California, W. B. CAMP (*U. S. Dept. Agr., Dept. Circ. 164* (*1921*), *pp. 22, figs. 11*).—Cultural operations, irrigation methods, and field practices applicable to the production of Pima Egyptian and Upland varieties of long-staple cotton in the San Joaquin Valley in California are described in this circular. A list of 52 publications dealing with the activities of this Department in connection with the establishment of Egyptian cotton growing in the Southwest is appended.

Community cotton improvement in North Carolina, R. Y. WINTERS, S. W. HILL, and P. H. KIME (*N. C. Agr. Col. Ext. Circ. 108* (*1920*), *pp. 30, figs. 10*).—Results of community tests of improved and local cotton varieties conducted in 20 counties in North Carolina are described, and considerable yield data, lint percentages, etc., are tabulated, continuing earlier work (E. S. R., 41, p. 439). Methods of selection and improvement adapted to farm conditions are briefly outlined.

The improved strains such as Cleveland, Mexican Big Boll, Lone Star, and Edgecombe-Cook, recommended by the North Carolina Experiment Station, are said to have yielded from $5 to $60 per acre more than the best unimproved varieties grown in the communities and to have averaged $28.97 more per acre than the varieties grown previously.

The fabric of civilization: A short survey of the cotton industry in the United States (*New York: Guaranty Trust Co., 1919, pp. 62, pl. 1, figs. 40*).—A concise account of the development of the cotton industry in the United States and its present status, with emphasis upon its financial features. The several steps involved from the picking of the cotton in the field to the production of finished cloth are illustrated and described in some detail.

Two Cuban malvaceous fiber plants, J. T. Roig and G. Martinez-Fortun (*Estac. Expt. Agron. Cuba Bol. 41 (1919), pp. 47, pl. 1, figs. 8*).—The two species *Urena lobata* and *U. sinuata* are described, methods employed in growing the crops and preparing the fiber for market outlined, and the cost of production and commercial possibilities discussed in brief.

Peanuts: Culture, trade, utilization, P. Vieira Souto (*Amendoim: Cultura, Commercio, Applicações Industriaes. Rio de Janeiro: Min. Agr., Indus. e Com., Deleg. Exec. Prod. Nac., 1919, 4. ed., enl., pp. 105, figs. 28*).—A fourth and enlarged edition of a popular treatise on the production of peanuts and peanut products in Brazil. Cultural and field practices involved in growing and harvesting the crop, and the various processes in the production of oil and other products, are described and illustrated, together with notes on the extent of production and trade in peanuts in Brazil and other countries.

The origin and early habitat of rye, A. Schulz (*Ber. Deut. Bot. Gesell., 37 (1919), No. 10, pp. 528–530*).—The author supplements work previously noted (E. S. R., 40, p. 632), continuing the discussion of the geographical origin of rye.

Sugar cane experiments, 1917–1919, J. de Verteuil (*Trinidad and Tobago Dept. Agr. Bul., 18 (1919), No. 3, pp. 136–152*).—Tests of seedlings and variety trials conducted in Trinidad from 1917 to 1919 are described.

Of seedlings tested in 1917 but a few showed promising field characters and analytical results, those from Bourbon cane giving the largest cane yields and those from a Hawaiian cane the best juice. M. P. 55, a Mauritius seedling, with 58.14 tons of cane and 5.46 tons of indicated sucrose per acre, led the variety tests at St. Augustine, and was followed by B. 14761, Ba. 6032, and B. 3922 with respective yields of 45.48, 46.78, and 42.33 tons of cane with 5.09, 4.96, and 4.82 tons of indicated sucrose Bourbon, with 26.88 tons of cane and 3.03 tons of sucrose, was exceeded by 18 varieties. It is stated that M. P. 55 led the tests solely on account of the high tonnage of cane per acre, as the quality of the juice was much inferior to that of any other variety.

Tobacco investigations [1916], W. Frear and O. Olson (*Pennsylvania Sta. Rpt. 1917, pp. 69–72*).—Improvement work with Pennsylvania Seedleaf (Broadleaf) varieties of cigar tobacco by section, adaptation studies on Clinton and Lycoming County soils, fertilizer tests, and spacing and topping experiments conducted in 1916 in continuation of work already noted (E. S. R., 43, p. 533) are briefly reviewed. The work was in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture.

On the protein content of wheat, W. F. Gericke (*Science, n. ser., 52 (1920), No. 1349, pp. 446, 447*).—In this contribution from the University of California, investigations to determine the effect of applications of certain forms of soluble nitrogen to wheat plants at different growth phases are described. White Australian wheat was planted in glazed stone jars on a soil very low in nitrogen. Nitrogen in the form of sodium nitrate and ammonium sulphate was added at the rate of 100 lbs. per acre in single applications to different jars at the time of planting and at intervals up to 110 days after planting.

Plants receiving sodium nitrate at time of planting and 17, 33, 48, 72, and 110 days afterward produced grain containing 8.6, 9.3, 10.4, 11.8, 13.2, and 15.2 per cent of crude protein, respectively. Not only was the protein content of the

grain increased by all the deferred applications of nitrogen, but the yields of plants receiving nitrogen from 33 to 72 days after planting were much larger than the yields of those receiving applications during the early growing period. The best quality of grain as determined by commercial grading was secured from plants receiving nitrogen 72 and 110 days after planting, indicating that the high protein wheat berry was also plump and well filled.

The author considers that the results obtained show that the low protein content of Pacific Coast wheats is not due primarily to climate, but that as far as the investigation with the soil used is concerned is due to lack of available nitrogen at certain growth periods of the plants. The emphasis to be laid upon the climatic complex is that it affects the nutrition of the plant in both kind and quantity of each of the different nutrients that may be available to it.

The production of wheat-rye hybrids, H. Firbas (*Ztschr. Pflanzenzücht., 7 (1920), No. 4, pp. 249–282*).—Results of experiments on the production of hybrids between wheat and rye are presented, and the technique and method of procedure employed are described. The pollinations were made with rye pollen, fresh, several hours old, and one day old, which was applied to stigmas on the day of opening of the wheat flowers and from 1 to 5 days after opening. The pollinations were also made with fresh and old pollen in enclosed rooms at various degrees of temperature and also when under different conditions of isolation.

Wheat varieties used successfully and the percentages of hybrids secured with each in pollinations include Loosdorfer bearded 1.9 per cent, Banat 2.1 per cent, Molds Squarehead 0.8 per cent, Czar 0.5 per cent, Red Galician bearded 3.1 per cent, winter speltz 4.8 per cent, and Bokhara 15.8 per cent. Numerous attempts made with Red Saxon, Svalöf 0315, Epp, spring speltz, and club wheat resulted in failure, and efforts to secure the reciprocal hybrid, rye×wheat, were likewise unsuccessful.

Summarizing the results, the author observes that the different breeds of wheat possess the faculty of hybridizing with rye in varying degrees. The success of the cross is also dependent on the individuality of the mother plant. The influence of individuality is not always of equal magnitude; in many races it is of the greatest importance while in others but little or none whatever. Individuality wields a greater influence in wild types than with cultivated sorts, and selection of definable forms could be readily made in the former. The influence of the individuality of the male parent could not be demonstrated in the wheat-rye hybridizing work.

The manner of isolating the heads played but small part in the success of the work, and the possible influence of climatic conditions were too small to be noticed. So long as the pollen possesses the ability to fertilize and the stigma is receptive, hybridization is considered feasible. No optimum period of development was found, and within reasonable limits the age of the pollen was not thought essential. Best results are said to be obtained by the plentiful application of pollen to the stigmas.

Longevity of seeds, F. A. Welton (*Ohio Sta. Mo. Bul., 6 (1921), No. 1–2, pp. 18–24, figs. 10*).—Factors affecting the longevity of seeds are discussed and longevity tests at the station are reported. The author contrasts the conflicting results of Vilmorin, Haberlandt, and Sifton (E. S. R., 43, p. 832) regarding the definiteness of the period of time during which the vitality of any particular kind of seed is maintained, and cites the work of Duvel (E. S. R., 16, p. 166), showing that seeds retain their vitality better in some localities than others.

When seeds of several kinds from crops of 1908 to 1919, inclusive, were stored and in 1920 tested at this station for germination, it was observed that increase in age of seeds was accompanied by a noticeable falling off in the rapidity of

growth and vigor of the sprouts. Photographs of the germinating seed of corn of the crops from 1908 to 1919, inclusive, illustrate this trend. The low vitality of seeds of wheat and oats maturing in the midsummer of 1915 was thought probably associated with the excessive humidity then prevailing, 8.35 in. of rain falling in July at Wooster, as compared with a 33-year average of 4.17 in.

Low germination percentages of red clover and sweet clover of the 1919 crop were due to "hard seeds," which were still hard after six days' test, with no signs of germination. Studies of Harrington (E. S. R., 33, p. 334; 35, p. 740) and Love and Leighty (E. S. R., 27, p. 524) are quoted to show the occurrence of "hard seeds" in various legumes and the means by which they may be rendered permeable. Scarification of sweet clover seed at the station raised the germination from 36 to 87.6 per cent.

Vilmorin's and Haberlandt's tables on the viability of seeds are appended.

Recent Pennsylvania weeds, A. A. Hansen (*Pennsylvania Sta. Rpt. 1917, pp. 317–328, pls. 6*).—Weeds recently introduced into Pennsylvania, including horse nettle (*Solanum carolinense*), field hawkweed (*Hieracium pratense*), star of Bethlehem (*Ornithogalum umbellatum*), Deptford pink (*Dianthus armeria*), Japanese knotweed (*Polygonum cuspidatum*), and Siberian crane's-bill (*Geranium sibiricum*) are described, distribution indicated, and control methods suggested. New weed species reported, but not proved dangerous, include keeled garlic (*Allium carinatum*), southern scabious (*Succisa australis*), western buckhorn or bracted plantain (*Plantago aristata*), and spotted knapweed (*Centaurea maculosa*).

HORTICULTURE.

[Horticultural investigations by the California Station, 1920] (*California Sta. Rpt. 1920, pp. 33–37, 37–40, 41, 42, 43, 44, 45, 46, 47, 49, 51, 52, 88, 89*).—Results of new and continued activities (E. S. R., 42, p. 830) are reported.

The trials with rootstocks for citrus as outlined by Bonns and Mertz (E. S. R., 35, p. 144) have been continued. A table prepared by R. S. Vaile gives the yields of Valencia oranges and Eureka lemons on four different stocks, sweet root, sour root, pomelo root, and trifoliata roots. Trifoliata has given measurably better results with Valencias than any of the others and the least favorable with Eureka lemons. The investigations of H. J. Webber in the selection of citrus rootstocks are again briefly noted.

Cooperative experiments with a number of orange growers have shown that the growing of early summer cover crops, as suggested by Coit and Hodgson (E. S. R., 40, p. 839), has been of material benefit in reducing the amount of June drop of the Washington navel variety. The Arlington grove experiment in the care of mature navel orange trees has been continued and the original 5-year term is now completed. The results to date, as summarized by Vaile, reaffirm the advantage of using stable manure in the fertilization of citrus trees.

The results obtained from fertilizer experiments conducted at the Citrus Substation have continued to emphasize the great importance of organic matter in the soil. The gradual decline of plats of citrus trees fertilized with nitrate of soda was accompanied by an increase of alkali in the soil and a diseased condition of the foliage, known as mottled leaf. The collection of citrus at the Citrus Substation now numbers about 500 varieties. Some of these, as Boone Early and Enterprise, are reported by Webber to show considerable promise. A test of 30 grapefruit varieties failed to reveal any superior to Marsh Seedless.

Dates were propagated successfully by the offshoot method in a specially constructed cloth-covered house, and data presented by Goar indicate the superior value of fresh shoots. In curing dates, dry heat was found superior to

steam. A method for cleaning dates is noted. M. E. Jaffa and H. Goss report a study of dates grown at the University Experiment Farm, El Centro, in which the moisture and sugar content of seven different varieties were determined.

Nine different varieties of avocado were analyzed by Jaffa and Goss, and the results are presented in tabular form. The oil percentage varied inversely with the size of the fruit. Analyses by Jaffa are also summarized as to the sugar content of prunes.

Further studies with cherries by W. P. Tufts and G. L. Philp confirm previous results that all sweet cherry varieties tested have proved to be self-sterile. Several cases of inter-sterility were found to exist between important commercial varieties. One of the most interesting developments is the isolation of several distinct strains of some of the more important varieties. The pollen of these strains has given quite different results when applied to flowers of one tree of another variety.

Extensive studies by Tufts show a very close correlation between the diameter of the trunk of young nonbearing deciduous fruit trees and the weight of the root and top. Light *v.* heavy pruning experiments with bearing apricot, prunes, peaches, and pears continue to show the superior value of light pruning in measure of yield. Summer pruning of vigorous growing peach trees is found to be a devitalizing practice.

Storage experiments by W. V. Cruess and E. L. Overholser show the possibility of storing apricots, cherries, currants, loganberries, red raspberries, and strawberries in various ways at 10° F. for a 10-month period without loss of flavor, quality, or color. Certain varieties of plums and pears are shown by Overholser to be specially adaptable to storage. Newtown apples held at 36 to 40° showed considerably less internal browning than at 30 to 32°. At 70° there was practically no browning. Winkler found that the amount of browning could be reduced by aeration or use of wrappers soaked in vegetable oils, which absorb the fruit esters.

Mature apricots, pruned by W. L. Howard by the so-called long system as compared with the former standard method of annual heading back, bore at an earlier age and yielded heavier crops.

Irrigation studies carried on during 1919 by F. J. Veihmeyer, with peaches at Davis and prunes in the Santa Clara Valley, to determine the relation of the trees to the amount of water in the soil, are briefly noted.

Studies by L. Bonnet at Davis indicate that certain Persian varieties of grapes are promising for shipping. F. J. Bioletti, F. C. H. Flossfeder, and A. E. Way found remarkable results in the girdling experiments with Black Corinth grape, the yield per vine having been increased from 8 lbs. to 30 lbs. Extensive investigations with phylloxera-resistant vine stocks at Davis and Kearney showed the superiority of other stocks to the commonly used Rupestris St. George. Investigations by Bioletti and Flossfeder show that much of the summer pruning commonly practiced in vineyards results in serious injury to the vines and a decrease in the yields (E. S. R., 39, p. 350). Bioletti and Way show that the yield of raisins is considerably increased by gathering the grape in a more advanced stage of ripeness than is usually practiced. The results of experiments by Cruess and A. W. Christie in the technique of evaporation of wine grapes are reported.

Among miscellaneous horticultural studies, there are noted tests of 5,000 citrus seedlings and 4,600 almond seedlings of known parentage, and studies by Overholser and Jaffa, of the effect of freezing temperatures on English walnuts.

[Report of the] division of horticulture, W. H. ALDERMAN (*Minnesota Sta. Rpt. 1920, pp. 46–51*).—Brief summaries of the progress of various projects are given.

At Cloquet, Minn., during the season of 1919, 44 wild blueberry plants (*Vaccinium pennsylvanicum*) were selected for propagation on account of superior size and quality. Cultural studies with the blueberry indicated the detrimental effect of manure applied either singly or in combination with peat. Of three methods of culture compared, namely, clean cultivation, mulching with peat, and shading with laths, clean culture gave best results in yield and quality of fruits. In propagation studies young shoots with a portion of the roots attached were far superior to cuttings or young plants.

Variety tests of various orchard and garden fruits were continued. A sport of Oldenburg (Duchess) of attractive red color is being propagated. Observations are made on the behavior of certain of the hardier nut trees.

Fruit-breeding investigations in hardiness, inheritance of fruit characters, and sterility were continued (E. S. R., 42, p. 833), and results briefly noted.

In the vegetable gardening projects several distinct strains of Alaska pea and Refugee bean have been studied with the aim of obtaining superior canning types. A study of F_1 and F_2 cucumber crosses indicates that characters studied segregate according to Mendelian laws. Experiments with first generation tomato hybrids were completed, the data indicating that in some hybrids the plants fruit earlier and yield a larger crop than either parent. The continued self-fertilization of Hubbard squash for four generations has resulted in the isolation of 15 distinct types which appear to breed true. A comparison with commercial strains of the same variety indicate a marked superiority in vigor and yield in favor of some of the selfed strains. Variations in weight of individual squash seeds were found to exert an influence on the vine and its yield. Two of these 15 inbred Hubbard squash strains show sufficient promise to warrant wider trial.

[Report of the] horticultural department (*Virginia Sta. Rpt. 1919, pp. 8–10*).—A summary of progress made with various horticultural projects during the year ended June 30, 1919.

In the study of the effects of soil environment on fruit-bud formation (E. S. R., 39, p. 346) it appears, after nine years of experimentation, that cultural treatments are more effective in promoting fruitfulness and tree growth than fertilizer applications. The cultivated apple and peach trees are larger, much more vigorous, bloom heavier, and produce more fruit than the uncultivated trees. It is suggested that fertilizer applications will show more noticeable results when the trees reach the age for full bearing. On young apple trees nitrogenous fertilizers stimulated vegetative growth, but phosphorus and potash did not produce apparent results.

Soil management and fertilizer experiments in commercial orchards have also shown tillage to be more effective than fertilizers in promoting tree growth and fruitfulness. Results from the use of fertilizers are contradictory. Nitrogenous fertilizers have usually given profitable returns, and in some cases a combination of nitrogen and phosphorus has been profitable. As a general rule, phosphates and potash have not been effective in increasing fruitfulness of the orchards. Work is being undertaken to determine the best source of and the proper time to apply nitrogen to fruit trees.

The commercial test of dwarf apple trees continued to confirm former conclusions that they have very limited usefulness in Virginia.

The gardener and the seedsman, J. B. KEIL (*Ohio Sta. Mo. Bul., 6 (1921), No. 1–2, pp. 14–17*).—The author points out the importance of selection of vege-

table seeds of merit and discusses the correlation between good seeds and reliable seedsmen.

Important lessons from [vegetable] experiments, S. W. Fletcher (*Pennsylvania Sta. Rpt. 1917, p. 85*).—Experiments with asparagus continue to show, as pointed out by Myers (E. S. R., 43, p. 537), the importance of grading the crowns at the time of planting. Continued breeding work with tomatoes again emphasizes the importance of considering the plant as the unit of selection, and indicates that not all plants which appear to be good are able to transmit their desirable characteristics to their progeny. Strains of cabbage of more than ordinary commercial value have been developed at the station. A study of rhubarb seedlings showed little resemblance to the parent, but a few plants were selected for propagation on account of apparent superiority to existing varieties.

Growing garden beans of high quality, J. B. Keil (*Ohio Sta. Mo. Bul., 5 (1920), No. 11–12, pp. 287–293, figs. 3*).—This is a brief report of a study of garden bean varieties, especially in relation to table quality. Descriptive, disease-resistance, and ripening notes for the six most satisfactory varieties are included.

[Report of the] fruit-breeding farm, Zumbra Heights, C. Haralson (*Minnesota Sta. Rpt. 1920, pp. 86–91*).—Several of the fruit seedlings originated and selected at the breeding farm were named during the year and some of these are now being propagated in a commercial way. Latham raspberry and Minnehaha strawberry are proving especially popular.

The report of the committee (B. B. Sheffield and N. J. Holmberg) examining the breeding farm in 1920 is included.

Freezing of fruit buds, F. L. West and N. E. Edlefsen (*Jour. Agr. Research [U. S.], 20 (1921), No. 8, pp. 655–662, pl. 1*).—In a contribution from the Utah Experiment Station, data are given on the "critical temperature" for the injury of fruit buds at various stages of development of apples, peaches, cherries, apricots, and prunes. This investigation was conducted to obtain data regarding the economic use of orchard heaters to prevent injury to fruit trees through freezing. The paper describes the methods used and results obtained in freezing more than 24,000 fruit buds, most of them apple or peach, and also the spring freezing temperatures and the yields of fruit in orchards near Logan, Utah, from 1913 to 1920.

Natural freezes and artificial freezing of twigs and whole trees were investigated, and it is claimed that the Ben Davis apple in full bloom may experience temperatures of 25° F. without injury, but usually 28° kills about one-fifth the blossoms. Twenty-nine degrees or above were found safe temperatures. With Elberta peach in full bloom, 29° or above is considered a safe temperature, although on most occasions 28° will kill from one-fourth to one-half the blossoms. Sweet cherry in full bloom has withstood temperatures as low as 25° without damage, but usually 29° kills about one-fifth the blossoms, and 30° is considered a safe temperature. Sour cherries are considered hardier than sweet cherries, the buds not being injured when just showing color by a temperature of 23°. When in full bloom 26° killed about one-fifth of the blossoms. With apricots 29° is said to be a safe temperature, 26° and 27° killing about one-fifth and 22° one-half the blossoms.

The figures presented above are said to refer for the most part to fruits in full bloom. Starting from this stage, the earlier the stage of development the hardier are the buds. When the fruit was setting the injury was found to be from 5 to 10 per cent more than when the trees were in full bloom. Sour cherries are considered the hardiest of the fruits, and then in order follow apples, peaches, apricots, and sweet cherries.

As an application of their investigation, the authors state that if the predicted minimum temperature is lower than the critical temperature by an amount that exceeds the rise in temperature that the heaters will produce, or if the minimum temperature is above the critical temperature, then the heaters should not be lighted.

Saving the girdled fruit trees, W. C. Gillespie (*Penn. State Col. Ext. Circ. 54 (1917), pp. 8, figs. 8; also in Pennsylvania Sta. Rpt. 1917, pp. 485–487*).—This contains practical instructions for bridge grafting girdled fruit trees. Preventive measures for the protection of trees are suggested.

Fruit trees, D. Hansen (*U. S. Dept. Agr., Dept. Circ. 147 (1921), pp. 12, 13*).—In a test of apple varieties at the Huntley, Mont., Experiment Farm, only a few sorts were found sufficiently hardy to withstand the severe winter conditions. Northwestern, Patten, and Wealthy, planted in 1911 and 1912, produced their first fruit in 1919. All varieties of crab apples under test have proved hardy, and of these Lyman, Excelsior, and Florence have given the best yields.

Ensee apple, an Ohio variety coming into prominence, F. H. Ballou (*Ohio Sta. Mo. Bul., 6 (1921), No. 1–2, pp. 12, 13*).—The author directs attention to the valuable qualities of this apple variety, pointing out the similarity to Rome Beauty in tree and fruit characters. In his opinion, Ensee surpasses Rome Beauty in quality of fruit and in value as a storage apple.

An orchard tragedy, F. H. Ballou (*Ohio Sta. Mo. Bul., 6 (1921), No. 1–2, pp. 9–11, figs. 2*).—This article describes a practical demonstration of the danger, due to soil erosion, of attempting to employ the annual tillage-cover-crop method of soil management for orchards in the hilly section of southern Ohio.

Influence of cultural methods on yield, growth, size, and color in apple orchards, J. P. Stewart (*Pennsylvania Sta. Rpt. 1917, pp. 451–467*).—The experiments reported in this section have been previously noted (E. S. R., 35, p. 644).

Influence of fertilization on yield, growth, size, and color in apples, J. P. Stewart (*Pennsylvania Sta. Rpt. 1917, pp. 468–484*).—A résumé of the progress of experiments started by the author in 1907 and 1908, the results of which have been previously noted (E. S. R., 35, p. 540).

Characteristics of peach varieties, P. Thayer (*Ohio Sta. Mo. Bul., 6 (1921), No. 1–2, pp 3–8*).—A contribution from the horticultural department containing notes on many of the peach varieties in the station orchards. An attempt is made to group the varieties according to date of maturity.

Australia and New Zealand as markets for American fruit, S. B. Moomaw and C. B. Sherman (*U. S. Dept. Agr., Dept. Circ. 145 (1921), pp. 16, fig. 1*).—A contribution from the Bureau of Markets relative to the development of trade in American fruits in Australia, Tasmania, and New Zealand. The fruit industry of these islands is analyzed from the viewpoint of home production, methods of marketing, export and import trade, and importation laws. Data are presented illustrating the costs of shipping fruit from the United States, and suggestions are offered for increasing the present volume of trade. Statistical tables relating to fruit production in Australia, the export and import fruit trade in Australia and in New Zealand, and marketing seasons of home-grown fruit in Australasia are appended.

FORESTRY.

Studies in French forestry, T. S. Woolsey, jr. (*New York: John Wiley & Sons, Inc., London: Chapman & Hall, Ltd., 1920, pp. XXVI+550, pl. 1, figs.*

21).—A compilation of information from reliable French sources, supplemented by general observations on the part of the author and W. B. Greeley, who contributes two chapters entitled Impressions of French Forestry and The American Forest Engineers in France. The subject is treated in detail and is accompanied by abundant statistical data, partly in tabular form, relative to size, location, and plant population of the French forests, and general forest practices. A bibliography of French forest literature, published from 1870 to 1912 and contained in the library of the Nancy Forest School, is included.

[Report of forestry investigations at the California Station, 1919–20] (*California Sta. Rpt. 1920, pp. 57–59, 89*).—Improved methods of preparing volume tables have been worked out by D. Bruce, whereby the inaccuracy of the present conventional practice is materially reduced. It was determined that the most satisfactory measurements for use as a basis for volume estimate were a breast height of 4.5 ft. and a merchantable height to a fixed top cutting limit as previously reported (E. S. R., 43, p. 443). A time study of log making and a yield table for eucalyptus, the latter by W. Metcalf, are included. The cause of the death of many eucalyptus trees has been found to be due to girdling injury by field mice.

Forest protection and conservation in Maine, 1919, F. H. Colby (*Lewiston, Me.: Land Agent and Forest Commr., 1919, pp. XXXII+163, figs. 105*).—The text of acts relating to fire protection, public lands, and forest laws is given. A progress report on operations for the control of the white pine blister rust is included, together with previously noted reports by Blackman on the spruce budworm, *Tortrix fumiferana* Clem. (E. S. R., 43, p. 852) and on the white pine weevil, *Pissodes strobi* Peck (E. S. R., 44, p. 166).

Fire protection for forest lands, E. Secrest (*Ohio Sta. Mo. Bul., 5 (1920), No. 11–12, pp. 281–286, figs. 3*).—A popular article, in which protection of existing woodlands is deemed more important in Ohio than setting new plantings. Damage from fire, causes of fires, necessary organization for fire control, and the need of education along these lines are among the subjects treated.

Quinquennial review of forest administration in British India for the period 1914–15 to 1918–19, to which is appended the annual return of forest statistics for the year 1918–19, J. Hullah (*Brit. India Forest Admin. Quinq. Rev., 1914–1919, pp. [13+31], pls. 3*).—Data relative to area of forests under control of the forest department, forest settlements, surveys, working plans, forest fires, planting operations, yields of forest products, principal exports, etc., are presented in tabular form. Comparative data on revenue and expenditures are given for the 20 years commencing 1899–1900, and also the average of six quinquennial years from 1869–70 to 1898–99. A list of forest publications issued by the Forest Research Institute during the 5-year period is included.

Administration report of the Forest Department of the Madras Presidency for the twelve months ending June 20, 1919, C. M. Hodgson, A. B. Jackson, H. A. Latham, H. Tireman, et al. (*Madras Forest Dept., Ann. Admin. Rpt., 1919, pp. 87+LXII+14*).—A report relative to the administration of the State forests in the Northern, Central, Southern, and Western Circles.

Annual report of the director of forests for the year ended June 30, 1920, E. H. F. Swain (*Queensland Dept. Pub. Lands, Ann. Rpt. Dir. Forests, 1920, pp. 65, pls. 12*).—The annual report of the activities of the Queensland Forest Service for the year ended June 30, 1920. Appendix D discusses forestry in Queensland, with special reference to the distribution of the principal timber trees, giving notes relative to weight, strength, and utility of the lumber of each.

The Douglas firs, A. Henry and M. G. Flood (*Roy. Irish Acad. Proc., 35 (1920), Sect. B, No. 5, pp. 67–92, pls. 3*).—In this botanical and silvicultural de-

scription of the genus Pseudotsuga, seven species are considered, three occurring in western North America and four restricted to small areas in western China, Formosa, and Japan. The authors separate the North American *P. taxifolia* into two distinct species, *P. douglasii* and *P. glauca*, and draw attention to the distinctive characters of each.

The utilization of bamboo for the manufacture of paper pulp, R. S. Pearson (*Indian Forester, 46 (1920), No. 12, pp. 603–631, pls. 2*).—An earlier paper by the author (E. S. R., 28, p. 645) is here revised to include recent information on the subject.

The timbers of India, A. L. Howard (*London: William Rider & Son, pp. 16, figs. 6*).—A brief description of the useful timbers of India, discussing the useful properties, distinctive characters, and particular economic uses of each species.

DISEASES OF PLANTS.

[Plant disease investigations by the California Station] (*California Sta. Rpt. 1920, pp. 40, 41, 43–45, 62, 63, 89, 90*).—Studies of the bacterial gummosis of apricots have been continued, and a number of varieties are said to have proved immune to attacks of the disease. Ninety-eight per cent or more of the infections are located within reach of the ground. It is thought that cutting out the canker and treating the wound with cyanid of mercury will check the disease. J. T Barrett, studying the apricot gummosis, found the optimum temperature for the growth of the organism to be about 24° C. (75.2° F.), and the maximum to be 32°.

H. Sevier reports that lime sulphur and Bordeaux mixture applied in sufficient strength to control leaf curl of peaches caused serious injury to foliage. Seventeen different strengths of the fungicide were applied and all did serious damage.

W. L. Howard and W. T. Horne claim that brown rot of apricots can be commercially controlled by spraying with winter strength of lime sulphur, dry lime sulphur, or Bordeaux mixture, just before the flower buds are opening. Commercial lime sulphur at summer strength, applied after the trees were out of bloom, had no effect in checking the rot and caused serious injury to the leaf buds then opening.

Howard conducted experiments to test the belief that almond roots are intolerant to even small quantities of copper sulphate solution, by dipping the roots of one-year-old almond seedlings in solutions of copper sulphate and Bordeaux mixture, and by painting wounds with the same materials, and also with dry Bordeaux paste. All the treated trees made vigorous growth, showing no injury from the treatments.

C. O. Smith continued his study of the resistance of Prunus stocks to crown gall, and found that a native plum (*Prunus watsonii*) showed marked resistance. Peaches, plums, and apricots have been grafted on roots of the native plum and are now planted in the orchard for further observation. The Japanese apricot (*P. mume*) is also said to show gall resistance.

An investigation of sun scald of deciduous fruit trees, made by J. P. Bennet, showed that the temperature of the tree tissues has an important bearing upon conditions favoring or opposing sun scald. Whitewashing during winter to reflect the heat was found advantageous, and it is claimed that under conditions at Berkeley the trunk temperature of a five-year-old peach tree may rise as high as 19.5° C. (35° F.) above the maximum air temperature on a sunny day. The temperature attained by different branches when equally exposed to the sun's rays is said to be proportional to their diameter. The investigations are said to indicate that heating of the growing layer of the

tree during the day alternating with frosty conditions at night favors sun scald, even during the dormant season.

Studies of pea blight by Jacobs and Leslie are said to show that the rotation of the pea crop where blight becomes established is necessary in California, and that seed infection is apparently not involved.

H. H. Severin has continued his investigations of beet blight, which tend to indicate that beet blight or curly top is not carried over in the seed from diseased seed beets, whether these become infected the first year or the scond year. It was found that curly-top beets continued to make growth by means of leaves in the early stages of the disease, but in the later stages when the leaves developed the warty condition they did not function sufficiently to give appreciable growth of the beet root.

Horne reports serious trouble from a disease of mushrooms. Upon investigation it was found that it was due to the fungus *Monilia fimicola*, which is not primarily parasitic but one that spreads from the compost.

S. S. Rogers and E. H. Smith have found that the internal brown streak of potato is due to soil and seasonal conditions affecting temperature and moisture. High soil temperature, from poor soil texture or shallow planting, and low moisture content are important causative factors of this trouble.

Attention is called to the kaolin dust mixtures discovered by R. E. Smith for use as insecticides and fungicides. These are said to be much more rapid of application than liquid sprays and are coming into quite general use.

Notes are given on diseases of cherry, plum, pear, fig, and raspberry, and it is claimed by J. W. Roberts that the eastern leaf spot of cherries, due to *Coccomyces* sp., has become serious in Sonoma County. Plum pockets is also said to have caused almost a total loss of the crop in many orchards about Sebastopol. A fig canker, which results in killing large areas on the crown and trunk, is being investigated by H. E. Drobish as to the relation of the disease to a species of Phomopsis isolated from infected bark.

A failure of loganberry, raspberry, and blackberry vines has been investigated, and faulty handling, together with root-decay fungi encouraged by overcrowding, are considered the important factors involved.

Barrett has continued observations on the dry root rot of citrus trees and has found a great increase in the distribution of the trouble, and also that very young trees may be attacked. Soil from which old navel orange trees have been removed produced 85 per cent infection on young trees subsequently planted. It is believed that trees of all ages are susceptible to this disease.

Some preliminary work is reported by Barrett on selection for bean resistance to rust, and by W. W. Mackie, in cooperation with the U. S. Department of Agriculture, on the control of cereal smuts and rusts.

Report of plant pathologist, A. F. Thiel (*Alabama Col. Sta. Rpt. 1920, pp. 30, 31*).—Brief reports are given of the pathological work carried on during the year covered by the report, most of the investigations having been conducted by E. F. Hopkins. The investigations consisted of a study of seed-borne diseases of forage plants, especially the leaf spot of bur clover (*Cercospora medicaginis*) and the leaf spot of vetch (*Ascochyta pisi*).

For the control of the leaf spot of bur clover, it was found that treating hulled seeds with 40 per cent formaldehyde for 2 hours or with a 1:1,000 corrosive sublimate solution resulted in the production of 100 per cent healthy plants. Where the seed was treated without removing the hulls, satisfactory results were not obtained. Preliminary experiments on the control of the leaf spot of vetch are said to indicate that this disease may be controlled by subjecting the diseased seed, with a water content slightly higher than normal, to high temperatures.

Department of plant pathology (*Fla. Plant Bd. Quart. Bul., 3 (1919), No. 2, pp. 82–85*).—Experimentation with practically all of the noncitrus trees commonly found in Florida indicates that the only one susceptible to citrus canker, even under inoculation, was the so-called wild lime (*Zanthoxylum fagara*). In this tree typical citrus canker spots developed, from which the canker could be made to infect grapefruit leaves, but in no case have the wild limes themselves been found to be injured by this disease.

The most effective and economical sterilizer for clothing and tools is a 1:1000 corrosive sublimate solution.

No cure was found for the disease when once established on the citrus host.

[Report of the] division of plant pathology and botany, E. M. FREEMAN (*Minnesota Sta. Rpt. 1920, pp. 51–53*).—Summaries are given of investigations on the rusts of cereals, cereal and forage crop diseases, potato and garden truck diseases, and diseases of various fruit-bearing plants.

In the study of the rusts of cereals, 25 distinct biologic forms of black stem rust have been isolated from varieties of wheat, and the behavior of wheat crosses to two biologic forms was investigated. It was found that forms can be obtained by hybridization which are resistant to at least two biologic forms when neither of the parents is resistant to both. An extensive study of cereal rusts, carried on in cooperation with the Bureau of Plant Indsutry, U. S. Department of Agriculture, is held to show quite clearly that the principal source of rust in Minnesota is the common barberry. Barberry eradication has been carried on on a large scale in the State.

Some investigations on smut resistance in corn, wilt resistance of flax, and various imperfect fungi on wheat, rye, and other cereals are reported upon. A wilt-resistant flax tested at a number of points has demonstrated that the resistance of the various selections was retained under the different conditions. It was further found that flax does not lose its resistance to wilt when grown in clean soil for a year.

A brief account is given of a Helminthosporium disease of wheat and rye, a more extended account of which by Stakman has already been noted (E. S. R., 44, p. 244). The temperature relations of the causal organisms of the scab of wheat have been determined and considerable information obtained on the host range of this species. It has been demonstrated that the wheat scab organism attacks several wild grasses and a number of forage plants and vegetables.

In the potato investigations the long-time spraying experiments have been continued. The results obtained indicated that spraying with Bordeaux mixture is a valuable practice over a period of years, even in the absence of late blight. Potato mosaic, leaf roll, curly dwarf, and related diseases have been studied, and it has been found that mosaic and leaf roll are undoubtedly infectious.

Among the fruit diseases reported upon, the gray bark disease of raspberries has been investigated and preliminary control experiments have been made. A comparative test of dusting and spraying fruit trees was conducted, and excellent results were obtained by dusting. As this method of the application of fungicides is considered simpler than the application of liquid sprays, it is believed that the substitution of dusting can be recommended if further results confirm those already obtained.

Notes on plant diseases in Pennsylvania for 1916, J. F. ADAMS (*Pennsylvania Sta. Rpt. 1917, pp. 329–336, pls. 10*).—Notes are given on the following diseases: Apple blotch (*Phyllosticta solitaria*), European apple tree canker (*Creonectria coccinea*), fruit spot of apple (*Cylindrosporium pomi*), hail injury, measles (due to an unknown cause), spongy dry rot (*Volutella fructi*),

chrysanthemum rust (*Puccinia chrysanthemi*), twig blight of horse chestnut caused by a fungus closely related to *Glomerella cingulata*, snapdragon rust (*Puccinia antirrhini*), and nematode injury to a number of plants due to attacks of *Heterodera radicicola*.

Department of plant pathology and bacteriology, F. D. FROMME (*Virginia Sta. Rpt. 1919, pp. 22–25*).—For the control of the black root rot of apples, due to *Xylaria* sp., tests have been made of various root stocks, and considerable variation in the susceptibility of the different varieties is reported. On most susceptible varieties the infection progressed in two years from the point of inoculation on a lateral root 2 in. from the crown into the crown, which was completely girdled. One variety appeared wholly immune to the disease.

Some of the results obtained from a study of the susceptibility of varieties of beans to the rust fungus *Uromyces appendiculatus* have already been published (E. S. R., 40, p. 845), and a number of crosses have been made between resistant and susceptible varieties of beans. Some selections have been made of resistant individuals which appeared in plantings of susceptible varieties.

For the control of the tomato-leaf blight due to Septoria the author reports the successful use of a soap-Bordeaux mixture previously described by Pritchard and Clark (E. S. R., 43, p. 846). Applications were made upon tomatoes grown at the station and in cooperation with commercial growers, with the result that respective gains of 72 and 77 bu. of ripe fruit per acre were reported. A bacterial fruit rot of tomatoes has been discovered and the organism isolated and used for infection experiments.

Some notes are given on the leaf spot of tobacco due to *Bacterium angulatum*, an account of which has been previously given (E. S. R., 40, p. 848).

As a result of the plant disease survey of the State the author reports a nematode disease of wheat as present in 28 counties. A field test on seed treatment and resistance of varieties of wheat indicates some variation in the resistance of varieties, but all were infected to a considerable degree.

Inspection of plant diseases (*Jamaica Dept. Agr., Ann. Rpt., 1920, p. 18*).—A successful fight is reported against the Panama disease of bananas, which showed for the year a decrease instead of the increase which might have been expected. Detailed records are given for the two half years, April, 1919, to March, 1920, with tabulation of diseased plants noted during the period 1911 to 1920.

Report of the microbiologist, 1919–20, [Jamaica], S. F. ASHBY (*Jamaica Dept. Agr., Ann. Rpt., 1920, pp. 25, 26*).—Banana wilt continued to be confined mainly to Portland. Coconut has shown but few cases of bud rot, and leafbite diseases have shown marked reduction. The trees in this important area are gradually throwing off the effects of the successive storms and are in a healthier condition than for several years. Sugar-cane mosaic or mottling disease was rather widespread but not severe, affecting a comparatively small number of plants, and is considered eradicable by the use of proper methods.

The biochemistry of resistance to disease in plants, R. A. GORTNER (*Minnesota Sta. Rpt. 1920, pp. 27, 28*).—In continuing investigations on the nutrition of the brown rot of plums (*Sclerotinia cinerea*) the author found indications that the presence of a substance similar to the water-soluble vitamin of animal nutrition was necessary for the normal development of the fungus. This vitamin was found to occur in considerable quantity in the juice of plums, peaches, and apples, and also in the sporophores of other fungi, in pollen, and in yeast. There is said to be some evidence of the presence of two vitamins, one required for vegetative growth and the other for reproduction. The relation of the vitamin occurring in the fruit to disease resistance is to be a subject of further investigation.

A disease of Clidemia hirta in the lower Rewa district, H. W. SIMMONDS and C. H. KNOWLES (*Fiji Dept. Agr. Circ., 1 (1920), No. 1, pp. 9–12*).—Notes are given on the appearance and progress of a die-back of *C. hirta*, which is thought to be due primarily to attack by nematodes, probably *Heterodera* sp., followed by the development of wound parasitic fungi. As a result the weed Clidemia is dying out in the districts affected.

Two destructive rusts ready to invade the United States, J. C. ARTHUR (*Abs. in Phytopathology, 10 (1920), No. 1, pp. 65, 66*).—Attention is called to a rust of peanuts occurring in Trinidad and other West Indian islands, and a rust of potatoes and tomatoes occurring in Costa Rica and Ecuador.

A disease of red clover and strawberry in the Pacific Northwest caused by the nematode Tylenchus dipsaci, L. P. BYARS (*Abs. in Phytopathology, 10 (1920), No. 1, p. 66*).—The author reports a serious disease of red clover and strawberry plants in the Pacific Northwest in 1919, caused by the nematode *T. dipsaci.*

On the strawberry the disease may be recognized by pronounced swellings of the leaves, petioles, stems, and stolons or fruiting branches. Affected plants are usually dwarfed and contain a large number of adventitious branches.

Severely infected red clover plants may be recognized by blister-like swellings of the leaves, petioles, and stems, and by the terminal bending of the stems. Such plants usually have a sort of witches'-broom appearance, due to the production of adventitious primary branches.

While the nematodes causing the above troubles are said to be morphologically alike, the author does not claim that they are physiologically identical.

Report on phytopathology (*Tijdschr. Plantenziekten, 25 (1919), No. 5, pp. 195–200*).—This report deals with a disease of wheat in the province of Groningen due to a Fusarium, experiments in the control of loose smut and stinking smut of barley and wheat, and stripe disease of wheat (*Helminthosporium gramineum*).

Varietal resistance and susceptibility of oats to powdery mildew, crown rust, and smuts, G. M. REED (*Missouri Sta. Research Bul. 37 (1920), pp. 3–41, pls. 4*).—The author brings together a large amount of data on the resistance and susceptibility of species and varieties of Avena to powdery mildew, crown rust, and loose and covered smut.

Inoculation experiments with powdery mildew on 98 varieties and strains belonging to 14 species of Avena were made, and negative results were obtained with but two, *A. bromoides* and *A. sempervirens*. In most cases complete infection occurred on every inoculated plant. Successful infection of *Arrhenatherum elatius* was also obtained in a few instances.

When 132 strains and varieties belonging to 7 species of Avena were tested with the crown rust of oats, 92 were fully infected in every experiment. In 34 varieties infection occurred in 75 to 99 per cent of the plants, and in 5 varieties 50 to 74 per cent of the inoculated plants were infected. The remaining variety gave 42 per cent infection.

In 154 varieties and strains belonging to 7 species of Avena tested with loose smut, consistently negative results were obtained with *A. brevis*, *A. sativa* var. Black Mesdag, *A. sativa nigra*, and *A. strigosa*. A number of other forms gave low percentages of infection. When 146 varieties and strains were treated with covered smut, the different species reacted to this smut in the same general way as they did to the loose smut.

[Truck crop diseases in Maryland], C. E. TEMPLE (*Md. Agr. Soc. Rpt., 4 (1919), pp. 277–281*).—Diseases observed during the season of 1919, which was unusually favorable to their occurrence, caused greater loss in Maryland than

in the previous year, especially to peas, cabbage, and tomatoes. Diseases of these crops are briefly discussed, as are also diseases of potatoes.

Crown gall of alfalfa, O. T. Wilson (*Bot. Gaz., 70 (1920), No. 1, pp. 51–68, pls. 4*).—This study is intended as a contribution to the knowdelge of the life history of the alfalfa crown-gall organism, the classification of which by different authors is briefly discussed.

The development of Urophlyctis alfalfæ, F. R. Jones and C. Drechsler (*Abs. in Phytopathology, 10 (1920), No. 1, p. 65*).—The authors report that the disease of alfalfa caused by *U. alfalfæ*, commonly known as crown wart, has been found to have its origin from the infection of very young buds, the foliar elements of which develop into abnormalities not involving the mature structures of root or stem. The characteristics of the fungus are briefly described.

Fifth progress report on Fusarium-resistant cabbage, L. R. Jones, J. C. Walker, and W. B. Tisdale (*Abs. in Phytopathology, 10 (1920), No. 1, p. 64*).—The authors report that the strain Wisconsin Hollander has maintained its character of relative resistance wherever tested, and is now grown almost exclusively on the cabbage-sick soils of Wisconsin. An equally resistant earlier strain of Wisconsin Hollander has been selected, and two strains of the leading kraut varieties have been developed. Arrangements are said to have been made to produce seed on a commercial scale in the Puget Sound region of Washington.

A mosaic disease of cabbage as revealed by its nitrogen constituents, S. L. Jodidi, S. C. Moulton, and K. S. Markley (*Abs. in Science, n. ser., 52 (1920), No. 1355, p. 588*).—The authors claim that the cabbage disease investigated is characterized by denitrification taking place in the affected tissues, whereby the nitrates are in part reduced to ammonia, which is lost as such, and in part to nitrites, which in reacting on the amino groups of the various organic compounds bring about the elimination of elementary nitrogen. On this account the diseased tissues have a smaller proportion of total, nitrate, acid amid, diamino, and monoamino nitrogen, nitrites occurring in diseased tissues only. There is said to be a higher proportion of protein in the diseased cabbage tissues than in the normal ones. A conspicuous characteristic of the cabbage disease is said to be the dwarfing of the plant, and this is readily understood when it is considered that the nitrogenous compounds, which are partly lost through denitrification, are the materials out of which the plant builds up its tissues.

Overwintering and control of bur clover leaf spot, E. F. Hopkins (*Abs. in Phytopathology, 10 (1920), No. 1, p. 66*).—Studies of the bur clover leaf spot are said to have shown that the causal fungus, *Cercospora medicaginis*, is borne as mycelium on the seed within the burs. By disinfecting seed in mercuric chlorid, rinsing in sterile water, and planting in agar, pure cultures of the fungus were obtained.

In attempting to determine methods of control, the effect of boiling on the fungus was investigated. It was found that boiling for as short a time as half a minute would kill the fungus without injury to the seed.

The author believes from the experiments that the mycelium occurs in the seed coats, and that the fungus is not carried over by means of viable conidia on the burs, as suggested by Wolf (E. S. R., 36, p. 450).

Sugar cane [diseases, Jamaica], P. W. Murray (*Jamaica Dept. Agr. Ann. Rpt., 1920, pp. 13, 14*).—The principal feature of the work herein reported was a survey of the cane mosaic disease situation in the island. Percentages of infection and tonnage as affected thereby are given for several parishes.

Composition of tubers, skins, and sprouts of three varieties of potatoes, F. C. Cook (*Jour. Agr. Research [U. S.], 20 (1921), No. 8, pp. 623–635*).—In a

contribution from the Bureau of Chemistry, U. S. Department of Agriculture, the author reports investigations on the composition of tubers, skins, and sprouts of potatoes of different varieties, and also of potatoes sprayed with copper fungicides for the control of late blight (*Phytophthora infestans*).

It was found that sprouts, skins, and tubers of three varieties of potatoes sprayed with Bordeaux mixture at laboratory temperature showed little variation in composition for the different varieties, the age of the sprout apparently influencing the composition more than the variety. It was thought possible that copper sprays might influence the time of sprouting by increasing or decreasing the rest period compared with that of the unsprayed tubers, but the data obtained for the variety Green Mountain indicated that the spray did not change the rate of growth or the composition of the sprouts.

Fusarium wilt of tobacco, J. JOHNSON (*Jour. Agr. Research* [*U. S.*], *20* (*1921*), *No. 7, pp. 515–536, pls. 5, fig. 1*).—As the result of a cooperative investigation carried on by the Bureau of Plant Industry, U. S. Department of Agriculture, and the Wisconsin Experiment Station, a description is given of a disease of tobacco which has been reported in Maryland and Ohio. The disease is said to be characterized by a yellowing and wilting of the leaves of the plant, usually followed by the death of the entire plant. The fibro-vascular system of the infected plants is characteristically brown or black.

A species of Fusarium has been isolated, and inoculation experiments have shown that it is the causal organism of the disease. The fungus is said to be closely related to *F. oxysporum*, and is described as *F. oxysporum nicotianæ* n. var. The conditions favoring infection by this organism are said to be heavy soil infestation, wounded host tissue, a relatively high soil temperature, and a susceptible variety. The White Burley variety of tobacco has been found most susceptible, and the Havana Seed and Cuban varieties are among the most resistant. Growers are advised to avoid the danger of infested seed beds and not to grow tobacco on infested soils.

Tobacco wildfire, G. H. CHAPMAN (*Mass. Agr. Col. Ext. Circ. 82* (*1920*), *pp. 7, figs. 3*).—A description is given of wildfire, a bacterial leaf disease of tobacco which has caused much damage in southern tobacco-growing sections and which was found in Massachusetts and Connecticut in 1920. The author also suggests control measures, and as wildfire is said to originate in the seed bed, most of the suggestions are in relation to the sanitation of the seed bed.

Tomato canker [in Holland], T. A. C. SCHOEVERS (*Tijdschr. Plantenziekten, 25* (*1919*), *No. 5, pp. 174–192, pls. 3*).—A disease of tomato is noted as new to Holland and to be due apparently to the presence of an Ascochyta of undetermined species, which is described.

Rust of tomato and potato, A. PACHANO (*Bol. Agr. Quinta Normal,* [*Ambato, Ecuador*], *1* (*1920*), *No. 1, pp. 7–12, figs. 2*).—A brief review is given of what is known of a rust of tomato and potato ascribed to *Puccinia pittieriana* as regards its appearance, its rapid increase in areas infected, and its injury to crops.

Factors that influence diseases of apples in storage, D. F. FISHER (*Better Fruit, 14* (*1919*), *No. 3, pp. 3, 4, 23–28, figs. 5*).—This is a nontechnical discussion of causes of injury to apples in storage, including defects in handling, packing, and shipping; diseases, both parasitic and nonparasitic; and measures to prevent injury in orchard, transit, and storage.

A condition resembling American peach rosette, W. A. BIRMINGHAM (*Agr. Gaz. N. S. Wales, 31* (*1920*), *No. 8, pp. 581, 582, pl. 1*).—In March, 1920, peach twigs having abnormal foliage were examined and found to show a condition resembling peach rosette, which had not previously been found in New South Wales. Discussion is given of the disease as known elsewhere.

Brown rot of peaches and its control, R. C. THOMAS (*Ohio Sta. Mo. Bul., 6 (1921), No. 1-2, pp. 26-30*).—On account of the frequent occurrence of the brown-rot fungus, the author recommends that control measures be employed every season to prevent the loss of peaches. He recommends spraying with a mixture of flowers of sulphur 8 lbs., hydrated or mason's lime 4 lbs., ground glue 1.5 to 2 oz., and water sufficient to make up to 50 gals. Orchard tests with this mixture are said to have given very satisfactory results.

A spray program for the protection of the peach, not only against brown rot but other diseases and insect pests, is given.

Bordeaux powders v. homemade Bordeaux mixture, H. E. LAFFER (*Agr. Gaz. N. S. Wales, 31 (1920), No. 8, p. 595*).—Tests briefly described are said to have shown that Bordeaux powders in dry form are of little benefit, but that when made up with water and sprayed on the vines there is little difference between these and the homemade Bordeaux mixture as regards grape fungus diseases.

[Cacao failures in Dominican Republic], J. A. STEVENSON (*Rev. Agr. [Dominican Repub.], 14 (1918), No. 9, pp. 265-273*).—Facts regarding the damage inflicted by cacao diseases are cited to show the necessity for preventive measures. The importance is emphasized of good living conditions for the plants and of laws regulating the importation of plants which may bear diseases injurious to cacao.

A brief history of the discovery of citrus canker in Japan and experiments in its control, trans. by T. TANAKA (*Fla. Plant Bd. Quart. Bul., 3 (1918), No. 1, pp. 1-15*).—Evidence is cited pointing to the presence in Japanese territory of citrus canker a few years previous to 1900, at which time it began to spread sufficiently to attract the attention of local growers. A brief account is given of investigations regarding the nature, development, and control of the disease.

Tear stain of citrus fruits, J. R. WINSTON (*U. S. Dept. Agr. Bul. 924 (1921), pp. 12, pls. 2*).—According to the author, Florida citrus fruits are subject to two distinct types of tear streaking, withertip tear stain and melanose tear streak. The former, which has usually been attributed to *Colletotrichum glœosporioides*, is discussed. Evidence is presented which is considered to indicate that *C. glœosporioides* is not responsible for tear stain in Florida, and that if the fungus ever produces such an effect, it must be extremely rare in that section.

As a result of spraying experiments and other investigations, the conclusion is drawn that practically all the so-called withertip tear stain in Florida is caused by rust mites and that the trouble can be readily controlled by controlling these pests.

The withertip of limes, J. B. RORER (*Trinidad and Tobago Dept. Agr. Bul., 18 (1919), No. 1, pp. 1-3, pl. 1*).—To an account by the author of an unusually severe outbreak (occurring in July and August, 1918) of withertip of limes due to *Glœosporium limetticolum*, with a description of the disease and a recommended treatment, a note is added by W. G. Freeman regarding conditions observed in Trinidad as due to what he supposes to be the same disease.

The fungus diseases of roses and their treatment, J. B. RORER (*Trinidad and Tobago Dept. Agr. Bul., 18 (1919), No. 1, pp. 29-31, pl. 1*).—These notes on rose diseases observed by the author include black spot disease (*Diplocarpon rosæ, Actinonema rosæ*), leaf spot (*Cercospora rosæicola*), powdery mildew (*Sphærotheca pannosa*), rose canker (*Stilbum* sp.), and red rust (*Cephaleuros virescens*).

Black stripe and moldy rot of Hevea brasiliensis, A. SHARPLES, W. N. C. BELGRAVE, F. DE LA M. NORRIS, and A. G. G. ELLIS (*Fed. Malay States Dept.

Agr. Bul. 31 (1920), pp. 7–60, pls. 7).—After a long period of freedom from black stripe canker, *H. brasiliensis* in Malaya showed the disease in serious epidemic form in 1916 following prolonged wet weather. Reasons are given for believing that it will prove to be a serious permanent cause of loss on rubber plantations in this region. A Phytophthora isolated and tested by inoculation experiments reproduced the disease. The fungus is described in culture. Methods of treatment and prevention as described include painting with an antiseptic solution during periods of wet weather.

Moldy rot, a disease of recently tapped surface of *H. brasiliensis* in Malaya, is described, and the present distribution of the disease is indicated. The causal fungus, *Sphæronema fimbriatum*, is discussed as to its appearance, isolation, growth in cultures, and control.

[Hevea brown bast disease control], J. R. HARMSEN (*Pubs. Nederland.-Indisch Landb. Synd., 11 (1919), No. 20, pp. 887–921*).—An account with discussion is given of the nature, symptoms, causation, effects, and control of brown bast of Hevea as studied locally.

Timber rot [in Dominican Republic] (*Rev. Agr. [Dominican Repub.], 14 (1919), No. 11, pp. 324–332, figs. 3*).—Discussion regarding timber rots (particularly those caused by *Schizophyllum commune*, *Polystictus occidentalis*, and *P. pirisetus*) and protection therefrom deals with their characteristics, causes, and control through prevention and treatment with a few standard fungicides.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The life history of the common mole (Talpa europea), L. E. ADAMS (*Jour. Min. Agr. [London], 27 (1920), No. 7, pp. 659–665*).—This is a brief account of the life history, habits, food, and natural enemies of *T. europea*. Measurements of moles, one each from several litters, which show the rate of growth, etc., from the day of birth up to the twenty-second day, when they are ready to leave the nest, are presented in tabular form.

Information concerning rat surveys and rat-proofing (*Pub Health Rpts. [U. S.], 35 (1920), No. 45, pp. 2615–2628*).—This article includes a discussion by C. V. Akin of the institution of rat surveys, together with a model building ordinance.

Hints on the care of peltries (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1921), No. 11, p. 180*).—This is a brief popular statement regarding the skinning, curing, and tanning of hides, furnished by the Bureau of Biological Survey, U. S. Department of Agriculture.

The African snail (Achatina fulica), J. C. HUTSON (*Trop. Agr. [Ceylon], 55 (1920), No. 4, pp. 217–225, fig. 1*).—The sudden appearance of this snail in certain districts of Ceylon during the last few years and its subsequent rapid increase in localities hitherto free from it led to the preparation of this account of its past history in Ceylon and its present status as a pest, with suggestions as to practicable measures for its control. It is a pest of vegetable gardens in most localities below an elevation of about 3,000 ft., but is not as yet known to do any serious damage to any of the chief crops of the island.

Report of entomologist, W E. HINDS (*Alabama Col. Sta. Rpt. 1920, pp. 22–25*).—A brief statement is made of Adams fund work with the rice weevil which was completed June 30, and with fumigation, and of investigations being made of the Mexican bean beetle (*Epilachna corrupta* Muls.) (E. S. R., 44, p. 657).

[Report on insect and insect control investigations] (*California Sta. Rpt. 1920, pp. 37, 43, 46, 51, 59–62, 90, 91*).—Fumigation investigations of red scale by H. J. Quayle and H. Knight have verified their earlier contention that in the Corona district this pest is more resistant to hydrocyanic acid gas than

it is in certain other districts, and that during the adult stage and the period of the second molt it is more resistant than it is in the other stages. It was found to be more resistant on a tree with heavy foliage than on one with light foliage, and the efficiency of fumigation was found to be 10 per cent less when there was an orange tree under a tent. In fumigation work a gas-proof tent made of balloon cloth proved satisfactory, and only 35 per cent of the cyanid necessary for tents now in general use was required.

In dusting cherries for thrips Nicodust applied with a Niagara power duster was found by E. O. Essig and W. L. Howard to kill all with which it came in contact. In the course of spraying experiments on apricots it was observed that the spraying of trees with commercial lime sulphur, 1:10, and dry lime sulphur, 12:50, almost completely controlled the peach-twig borer when applied twice before the trees came into bloom. The spraying of trees after they came into bloom with either of the two had little effect against the borer, and Bordeaux mixture and oil sprays afforded no protection. Commercial lime sulphur 1:10, dry lime sulphur 12:50, Zeno distillate emulsion 1:15, and Ortho crude oil emulsion 15:100, all appeared to destroy from 85 to 95 per cent of the eggs of the clover mite on cherries. In dusting experiments with prunes in the Santa Clara Valley, by Essig and Howard, Nicodust applied with the American Beauty hand duster and also with the Niagara power duster killed the thrips almost instantly, but since the dust can not penetrate the unopened flower or leaf buds two or three applications may be necessary. It is pointed out that the dust may be applied very rapidly with a power outfit, and that the cost of the dusting material for full-grown trees amounted to about $3 per acre per application. The practicability of the disinfection of cuttings and rooted vines by hot water to free them from phylloxera without injury was investigated by F. T. Bioletti and L. Bonnet.

Brief reference is made to life history stud es of the codling moth in walnuts by Quayle, an account of which has been noted (E. S. R., 44, p. 253). In investigations conducted by Essig during the months of January, February, and March in the Santa Clara Valley, crude-oil emulsions, distillate emulsions, and miscible oils gave excellent results in killing the brown apricot scale, and it was found that the Italian pear scale (*Epidiaspis piricola* (Del G.)), which chiefly attacks the prune and apple and is widely distributed in the Santa Clara Valley orchard districts, may be controlled at the same time with the same materials (E. S. R., p. 654). It is said to have been shown by orchard practice that the crude-oil emulsions are much more effective in killing *E. piricola* than are the lighter distillate emulsions and miscible oils.

The life history of the beet leafhopper was determined by H. H. Severin in the northern section of the San Joaquin Valley. Five broods were bred, the first generation completing its life history on the pasture vegetation of the plains and foothills and four broods on sugar beets and 35 different species of weeds growing in the cultivated area.

Mention is made of the malaria-mosquito survey by W. B. Herms et al. and malaria-mosquito control work by S. B. Freeborn and of the supply of water by E. R. De Ong for making sprays in the Santa Clara Valley. Crude-oil emulsion is said to have shown a higher percentage of efficiency against the winter egg of the clover mite than distillate oils or lime sulphur in experiments conducted by De Ong.

In studies by G. A. Coleman of the so-called disappearing disease of bees, no bacterial agent which might be the cause was discovered. The conclusion was reached that the death of a large number of adult bees was due to a combination of causes.

Division of entomology and economic zoology, W. A. Riley (*Minnesota Sta. Rpt. 1920, pp. 41–44*).—The work here briefly reported upon includes investigations of measures for protecting wheat flour substitutes from insects, the relative susceptibility of various cereals to insect attack, the life history and methods of control of the chicken nematode (*Heterakis papillosa*), Drosophila flies as a pest and as possible disease carriers in dissecting rooms, orchard spraying, the toxicity of arsenicals, etc.

It is found that a temperature of 43° F. will prevent all development of the confused flour beetle (*Tribolium confusum* Dur.), which is one of the worst pests of cereal products. The investigations conducted have led to the conclusion that insects which attack sound grain can not survive in milled products, that those which work in milled products can not survive in sound grain, and that moist and moldy products are subject to attack by insects which require fungi for their diet.

In continuation of investigations of the toxicity of insecticides, work is being conducted based on the assumption that the leaves of plants when wet exhibit a negative electrical charge, that the arsenicals used at the present time also exhibit a negative electrical charge, and that if an arsenical can be prepared with a positive electrical charge greater adherence to the foliage will result.

In orchard spraying work the Nova Scotia Bordeaux-calcium arsenate spray controlled apple scab better than any other spray. "Dust arsenate of lead, 15 per cent, and sulphur, 85 per cent, gave excellent results. The dusted trees showed fruit with less scab per individual apple than the liquid spray, and on the whole gave a better percentage of No. 1 saleable apples. The scab was not well controlled on the plat sprayed with liquid arsenate of lead and lime-sulphur mixture."

Biennial report of the State Plant Board of the State of Mississippi, R. W. Harned (*Miss. State Plant Bd. Bien. Rpt., 1918–19, pp. 40*).—Included in this report are brief accounts of the sweet potato weevil, its control and eradication, scouting for the pink bollworm and other pests, etc.

Fragments in the life habits of Manitoba insects, I, II, N. Criddle (*Canad. Ent., 51 (1919), No. 5, pp. 97–101; 52 (1920), No. 6–7, pp. 121–125*).—The first paper presents notes on the habits of *Pacilopsis* (*Apochiema*) *rachelae* Hlst., *Leucobrephos brephoides* Wlk., *Hemileuca lucina latifascia* Barnes and McDunn, *Musca domestica* L., *Cicindela limbalis awemeana* Casey, and *Eleodes tricostata* Say.

In the second paper it is pointed out that in a province such an Manitoba, which is comparatively new agriculturally, insect outbreaks involving species not hitherto known to be injurious are continually occurring. Outbreaks of two such pests have occurred in Manitoba within the last few years, notes relating to which are presented. The first is that of the brome grass cutworm (*Trachea finitima cerivana* Smith) and the second that of the aspen leaf curler (*Proteopteryx oregonana* Wlshm.). Brief summaries are given of the status of knowledge of these insects, the injury caused, and control measures.

Economic insects in Norway in 1919], T. H. Schøyens ([*Norway*] *Statsentomolog, Ber. Skadeinsekt. Plantesykd., 1919, pp. 52, figs. 40*).—Accounts are given of the more important insect pests of the year, arranged under the crops, etc., attacked.

Insects injurious to economic crops in the Zanzibar Protectorate, W. M. Aders (*Bul. Ent. Research, 10 (1920), No. 2, pp. 145–155, pls. 3*).—Insects of economic importance in the Zanzibar Protectorate are briefly noted under the heading of crops attacked.

Nursery and orchard insect pests (*Missouri Sta. Bul. 176 (1920), pp. 35, figs. 31*).—This is a popular summary of the more important pests of the apple, pear, peach, plum and cherry, grape, gooseberry and currant, blackberry and raspberry, and strawberry.

On the use of experimental plats when studying forest insects, I. TRÄGÅRDH (*Bul. Ent. Research, 10 (1920), No. 2, pp. 157–160, figs. 2*).—The author describes the method employed during an outbreak of the pine-tree looper (*Bupalus piniarius* L.) in Sweden in 1916–17.

Entomology for medical officers, A. ALCOCK (*London: Gurney & Jackson, 1920, 2. ed., rev., pp. XV+380, pl. 1, figs. 197*).—This is a discussion of insects in their relation to disease transmission, intended particularly for use by medical and sanitary officers.

The action of chloropicrin on insects infesting stored grain and on rats, A. PIUTTI (*Compt. Rend. Acad. Sci.* [*Paris*], *170 (1920), No. 14, pp. 854–856; abs. in Rev. Appl. Ent., 8 (1920), Ser. A, No. 7, pp. 260, 261*).—Excellent results were obtained in the control of stored grain pests by the use of chloropicrin when 20cc. per cubic meter was used at a temperature of 59 to 68° F. and permitted to act for a period of about a week. Neither the flour nor the bread made from such grain deteriorated so far as its nutritive value is concerned, although about 30 per cent of the germinating power of the grain was lost. Rats experimented with, with a view to exterminating the pests on ships, were destroyed after 2.5 hours' exposure, the fleas infesting the rats being killed in even less time.

The use of hydrocyanic acid gas for fumigation, W. G. LISTON (*Indian Jour. Med. Research, 7 (1920), No. 4, pp. 778–802, pls. 5, figs. 4*).—A general account of the use of this fumigant as an insecticide and its use in India, particularly in vessels. A brief description is given of the plant erected at the Alexandra docks, Bombay, for fumigating kit, etc.

Further notes on the food plants of the common earwig (Forficula auricularia), H. H. BRINDLEY (*Cambridge Phil. Soc. Proc., 20 (1920), No. 1, pp. 50–55*).—Observations made during 1917, 1918, and 1919 are reported (E. S. R., 42, p. 851).

Sugar-beet root-louse control, D. HANSEN (*U. S. Dept. Agr., Dept. Circ. 147 (1921), pp. 11, 12*).—This is a report of root-louse control work in 1919 at the Huntley (Mont.) Experiment Farm, in continuation of that previously noted (E. S. R., 43, p. 451) this being the sixth year of the experiment.

Varying numbers of irrigations, from two to five, were applied, the plats receiving the larger number of irrigations being irrigated the first time somewhat earlier and the last time later than is commonly done in farm practice. It was the purpose to determine whether early irrigation and frequent later irrigations to keep the soil in a moist condition at all times would be effective against the spread of the root lice, which takes place during the early part of July, and in preventing serious damage to the beet crop. The results in these experiments, reported in tabular form, confirm those of previous years, and indicate that less infestation by the root lice occurs when five irrigations are applied, that the yields are increased, and that the beets that are free from lice invariably contain a larger percentage of sugar.

Preliminary note on antennal variation in an aphis (Myzus ribis L.), M. D. HAVILAND (*Cambridge Phil. Soc. Proc., 20 (1920), No. 1, pp. 35–44, fig. 1*).—This is a report of data obtained in connection with studies previously noted (E. S. R., 41, p. 756), which are presented in large part in tabular form.

The rosy apple aphis (Aphis malifoliæ Fitch [sorbi Kalt.]), M. T. SMULYAN (*Virginia Sta. Rpt. 1919, pp. 38–64, figs. 3*).—The account here presented is based upon studies conducted at Blacksburg and vicinity, at an altitude of

2,400 ft., during the years 1915 and 1916. The studies relate to the aphis as found on the apple out of doors until late in the summer and on small potted trees in cages in the insectary shed, where it remains on the apple all summer and into the fall. No detailed study was made of the forms on plantains (*Plantago lanceolata* and *P. major*). A key and descriptions are given for the separation and determination of the first instar stem mothers of *A. malifoliæ*, *A. pomi* DeG., and *A. prunifoliæ* Fitch.

It was found that, in general, hatching begins about the time the outer scales of most of the terminal buds have broken and the buds are showing green, or about the same time as that of *A. pomi* and from about 10 days to 2 weeks subsequent to that of *A. prunifoliæ*. The period extends over about 2 to 2.5 weeks. The nymphal period varies from 12 to 24 days, with an average of about 19 days. The average duration of the instars was, respectively, about 8.5, 3.5, 3, and 3 days. Reproduction in most instances began during the first 24 hours following the last molt, the longest interval being about 42 hours. The smallest number of offspring produced by one individual, out of a total of 22, was 21, the largest number 289, and the average 202.4. The largest number of young produced in one day was 26. The length of adult life varied from 12 to 48 days, with an average of about 33.5 days.

In the second and subsequent generations the length of the nymphal period varied from 7 days, in the case of an individual of the tenth generation, to 16.5 days, in the case of one belonging to the second generation, the average being about 9.75 days. Two individuals apparently molted five times. Reproduction may begin during the first 24 hours following the final molt, or not until during the following 24. In one instance it is definitely known to have begun within a few hours after the adult stage was reached.

Winged females, under the same conditions, develop as a rule somewhat more slowly. In these the duration of the nymphal period varied from 8 to 16 days, the average length being about 11.5 days. Data bearing on the duration of the individual instars in the development of the latter form are not available, owing to their failure to develop in this series of the experiments.

The largest number of young per female, wingless, produced by 32 individuals which were followed throughout their productive period, was 196, the smallest number 27, and the average number 114.43. The length of the reproductive period varied from 6 days, in the case of the female which produced only 27 young, to 33.5 days, the average being about 23 days. The length of the adult life varied from 7.5 days to 43 days, with an average of about 29.5 days.

A maximum of 12 generations was reared in 1915 up to about the time the aphids completely disappeared from the apple trees out of doors (about the end of the first week in August), and a maximum of 17 to about the time the species commenced to return to the apple from the plantains during the first days of October. Similarly, there was a maximum of 14, at the beginning of the fourth week in August, and 17 at the beginning of the last week in September in 1916.

The first winged viviparous females, or return migrants, were found October 2 in 1915 and September 24 in 1916, the apple grain aphis beginning to return about the same time. The nymphal stages of the return migrant and male occur exclusively on the alternate host plants. The winged females and males may persist on the apple out of doors until about the middle of December, and reproduction on the part of the former continues until about the middle of November. Similarly, wingless viviparous females may continue on plantains out of doors until early in December, at least on the broad-leaved plantain (*P. major*), on which they are relatively more numerous during the latter part of

the fall and on which they seem to persist longest. The egg-laying females begin to be deposited on the apple about as soon as winged viviparous females arrive. Oviposition commences about the middle of October and continues until within a short time of the death of the females. The oviparous females persist somewhat longer than the winged females and males.

Nine hymenopterous parasites were reared by the author, namely, *Lysiphlebus testaceipes* Cress., *Ceraphron* sp., *Asaphes americana* Gir., *Propachyneuronia siphonophoræ* (Ashm.), *Pachyneuron* spp., *P. virginicum* Gir., *Aphidius phorodontis* Ashm., *Lygocerus stegmatus* Say, and *Tetrastichodes detrimentosus* Gahan. A list of predators includes nine coccinellids, the dipteran *Leucopis griseola* Fall., and a chrysopid.

While *A. prunifoliæ* was abundant on the trees, *A. malifoliæ* was scarce, and definite conclusions regarding its control could not be drawn. The experiments conducted indicate that good control of *A. prunifoliæ* may be obtained through one application of 40 per cent nicotin sulphate in water, at the rate of 1 to about 1,000, and soap 4 lbs. to 100 gal. applied about the time the compact green-showing buds begin to unfold, by which time the aphids of this species have all hatched. "There seems to be little or no advantage in a later application of nicotin sulphate (1 to about 1,000) in lime sulphur (1 to 20) at the time the flower clusters show pink, if the early application is well timed and thorough. One spraying consisting of an application of nicotin sulphate (1 to about 1,000) in lime sulphur (1 to 20) at the time the flower buds show pink is apparently of little or no benefit. *A. prunifoliæ* seems not to affect either the yield or quality of the fruit, even when abundant, and it may be regarded, therefore, under usual conditions, as being of but slight, if of any, injury to apples." The experiments show that the nicotin lime sulphur combination at the time the flower clusters show pink is far less effective than the nicotin water and soap solution earlier in the season.

Woolly-aphis control tests at Papanui, G. STRATFORD (*New Zeal. Jour. Agr.*, *21* (*1920*), *No. 2*, *pp. 85*, *86*).—In tests made at the Papanui (New Zealand) Experimental Orchard during the year, spraying with red oil at the strength of 1:10 heated to 120° F., gave the best results in winter control, while painting with red oil at the strength of 1:1 gave fairly good control. In summer control work Blackleaf 40 gave the best results, and there appeared to be no advantage in adding lime sulphur to it.

Commercial-sulphur products as dormant sprays for control of the San José scale, M. C. TANQUARY and M. E. HAYS (*Texas Sta. Circ. 24* (*1920*), *pp. 8*, *figs. 2*).—In this first year's work with the commercial-sulphur products three materials were tested, namely, Niagara soluble sulphur, 12.5 lbs. to 50 gal. of water; Sherwin-Williams dry lime sulphur, 15 lbs. to 50 gal. of water; and Grasselli liquid lime sulphur, 1 gal. to 8 gal. of water. The materials were applied with a barrel sprayer with a two-cylinder pump and a disk nozzle at a pressure of 175 to 200 lbs. The application was made February 24, which is about as late as the dormant spray can be applied in the locality of Tyler. The results of this preliminary experiment, which are reported in detail in tabular form, indicate that all three materials were very effective in controlling the San José scale under the conditions of the experiment, there having been very little, if any, difference in their effectiveness.

Annual report of the Royal Sericultural Station, Padua, L. PIGORINI ET AL. (*Ann. R. Staz. Bacol. Padova*, *43* (*1919–20*), *pt. 1*, *pp. 88*, *figs. 2*).—This is in continuation of reports previously noted (E. S. R., 38, p. 859). Included are papers by R. Grandori, on the segmentation of the fecundated egg of *Bombyx mori* when submitted to winter conditions immediately after deposition (pp.

19–43) and by C. Ghirlanda, on *Botrytis bassiana* as a means of combating *Cnethocampa pityocampa*, the pine tree procession moth (pp. 44–49).

Experiments on borer control, J. P. Stewart (*Pennsylvania Sta. Rpt. 1917, pp. 79, 80*).—This relates to control work with borers, in continuation of the work previously noted (E. S. R., 43, p. 554). Of the 20 materials tested, dense lime sulphur and the various asphaltum compounds now appear to be the most promising. The Durable Lac tree varnish, which is an asphaltum preparation, has been applied to the trunks of young apple trees for five consecutive years and has maintained an excellent coating without apparent injury, although similar in type to other materials which have proved injurious.

Our present knowledge of the pale western cutworm [Porosagrotis orthogonia Morr.], J. R. Parker, A. L. Strand, and H. L. Seamans (*Montana Sta. Circ. 94 (1920), pp. 8, figs. 2*).—This is a review of the present status of knowledge of the most destructive cutworm that has appeared in Montana and the most difficult to control. The account is based upon several years of observation and a definite study conducted during the past two years. Previous to 1911 this species had been looked upon as a rare insect and had never been known to attack crops, but during that year it became very abundant in Alberta, Can., and destroyed approximately 40,000 acres of grain. Since that time it has gradually spread southward into Montana, until it occurs more or less abundantly over all the State east of the continental divide, with the exception of a few districts along the southern part.

This pest cuts off grain plants of all kinds an inch or two below the surface of the ground, taking only a small portion of the tender stem, then moving along the drill row to the next plant. A single worm working in this way kills a large number of plants leaving the tops to wither and blow away. Entire fields of hundreds of acres may be completely destroyed or, if the worms are less numerous, the injury may show up in irregular patches. During the season of 1920 this cutworm destroyed approximately 250,000 acres of grain in Montana. It moves only a short distance, and if it fails to find a plant within a few feet remains where it is, perhaps, for several weeks, without feeding or growing to any extent, thus making it impossible to reseed the same season, since it merely resumes its work when a new crop comes up. It is stated that there are instances where the same worms in a field completely destroyed the winter wheat in the fall and two seedings of spring wheat.

The moths emerge during the last half of August and have laid most of their eggs by the end of the first week in September The eggs are deposited in soft mellow dirt about 0.25 in. below the surface, recently-worked fields being especially attractive to the moths. Each moth lays between 200 and 300 eggs, which are deposited in groups of 3 to 10. The eggs are ready to hatch within a few days after deposition, but hatching does not take place as long as the eggs remain dry. Thus they may hatch either in the fall or early spring, depending upon the amount of moisture in the soil. The worms begin to feed as soon as spring opens, but their work generally does not attract attention until about May 1, at which time they are about an inch long. They continue to feed heavily until late in June, at which time most of them have acquired their growth and become inactive. On completing their growth an earthen cell is formed from 2 to 3 in. below the surface of the ground, in which they pupate.

The poisoned bran mash has proved to be a failure as a means of control. Both plowing furrows and rolling the ground have also failed. The information obtained indicates that fields which had been heavily soaked with water during irrigation suffered much less than other fields not irrigated. It has

been found that under favorable conditions moths are easily attracted to lights, and in experiments conducted as many as 1,500 moths were caught at one trap in a single night. The trap-light experiments have not, however, been carried far enough to warrant recommendation and will be continued.

The fact that grain grown on one side of a fence may be totally destroyed by this pest while the crop on the other side is practically untouched led to personal interviews with 250 farmers, growing 20,000 acres of grain in infested districts, from which it was determined that the pest has been most abundant and injurious in fields where the soil has been in a soft and mellow condition during August of the preceding summer. This has led to the definite recommendation that in districts where the pest is abundant fields which are to be cropped the following year should not be disturbed in any way between July 15 and September 15. It is pointed out that land which was idle the previous year and not cultivated from July 15 to September 15, and in which no cutworms can be found on early examinations, can be seeded with the best chances of success. Land which was not so handled can be tested by sowing across it, at the very earliest date possible, a strip of wheat, and by the time this strip of grain gains a height of 3 or 4 in. it can be determined whether the cutworms are present.

Due to its subterranean habit this cutworm is protected from the attack of parasitic insects.

The life history and control of Agrotis segetum Schiff., H. Zimmermann (*Fühling's Landw. Ztg., 67 (1918), No. 7-8, pp. 130-148*).—A somewhat extended discussion is given of this cutworm, based on observations at the Rostock Agricultural Experiment Station. A study of the relation of the weather to its injury is included, based on observations extending over a period of five years.

Observations upon the instars of Phryganidia caterpillars, F. B. Herbert (*Ent. Soc. Wash. Proc., 22 (1920), No. 8, pp. 193-200, figs. 3*).

Papulo-urticarial rashes caused by the hairlets of caterpillars of the moth Euproctis edwardsi Newm., J. B. Cleland (*Aust. Med. Jour., 1 (1920), No. 8, pp. 169, 170, fig. 1; abs. in Jour. Trop. Med. and Hyg. [London], 23 (1920), No. 11, p. 148*).—The occurrence of irritating rashes among people living at Lindfield, near Sidney, Australia, following the handling of dead wood, led to investigations which have shown the rashes to be due to hairlets of caterpillars of *E. edwardsi*.

Cytology of the blood of caterpillars of Macrolepidoptera, A. Paillot (*Compt. Rend. Acad. Sci. [Paris], 169 (1919), No. 4, pp. 202-204*).—The author here reports upon studies made of the blood of the brown-tail moth, gipsy moth, cabbage butterfly, *Vanessa urticæ, Eriogaster lanestris, Arctia caja*, and *Agrotis segetum*.

Biological investigation of California rice fields relative to mosquito breeding, W. C. Purdy (*Pub. Health Rpts. [U. S.], 35 (1920), No. 44, pp. 2556-2570, figs. 6*).—From investigations on one California rice ranch and on near-by waters, carried on during the season of 1919, the following conclusions are drawn:

"Breeding of mosquitoes (both Anopheles and Culex) is practically absent from the rice fields themselves, but moderate or heavy production is going on meantime in near-by seepage puddles and natural drainage ditches. The season's investigation shows that for 1 mosquito produced by the rice fields the seepage puddle produces 5 and the natural ditches 44.

"The larval food supply, being about equal in quantity and comparable in kind in rice fields, in puddle, and in ditches, is evidently not responsible for the great discrepancy in numbers of larvæ. The discrepancy is not entirely due to

activity of larval enemies, because these are most numerous where larvæ are most abundant and least numerous where larvæ are practically absent. Heavy growth of blue-green algæ and the presence of surface films on rice fields constitute the most noticeable differences between these nonbreeding places, the rice fields, and the heavily breeding places, the ditches, where films are absent and blue-green algæ are not abundant. The seepage puddle repeated, on a larger scale, the fluctuations of the rice fields in numbers of larvæ, in food content, and in number of enemies.

"It is apparently out of the question to control mosquito production in natural uncared-for waters, including rice fields, by attempting to diminish the larval food supply, or by the introduction of natural enemies with the exception of certain fish. The natural mechanism of control as found in the California fields seems to be concerned, in part at least, with the general condition of stagnation, the large amount of blue-green algæ, and the biological surface films. These conditions prevailed on the rice fields from July 20 (about) to the latter part of September. The conditions just stated fail to account for the negative results obtained during June and part of July.

"Collections of imagoes show *A. occidentalis* (thought to be an efficient vector of malaria) to be present throughout the year and to be present very abundantly in August and September. Males probably do not live through the winter, for none could be found from November 19 to April 27."

Can the mosquito convey infection from a malaria patient undergoing treatment?—Does sporogony affect mosquito life? B. MAYNE (*Pub. Health Rpts.* [*U. S.*], *35* (*1920*), *No. 28, pp. 1664–1669, figs. 2*).—A discussion of the effect that quinin exerts on the mature gametocyte when it is taken up and elaborated in the mosquito, including a review of the literature with quotations, and a report of personal observations.

It is shown that some mosquitoes infected with the malaria parasite may live to reach an advanced age. It also appears that a mosquito may become infected from the blood of a patient that has received as much as 480 grains of quinin, and that such a mosquito is capable of infecting a healthy person.

Mosquitoes and bats, L. O. HOWARD (*Pub. Health Rpts.* [*U. S.*], *35* (*1920*), *No. 31, pp. 1789–1795*).—This is a paper delivered at the third annual meeting of the New Jersey Mosquito Extermination Association at Atlantic City, N. J., in February, 1916, and previously noted (E. S. R., 39, p. 867).

On the possibilities of using mosquito traps in antimalarial work, C. W. METZ (*Pub. Health Rpts.* [*U. S.*], *35* (*1920*), *No. 34, pp. 1974–1977, pl. 1*).—A description of and collection records are given for two traps conducted near Plant City, Fla. Examinations made while the traps were in operation indicated that most of the Anopheles in the immediate neighborhood at any one time were in the traps.

"Meager as these data are, they serve to demonstrate two things: First, that Anopheles react sufficiently to some stimuli to be enticed into traps, and, second, that under the conditions of the present experiment the use of traps serve to keep near-by buildings practically free from Anopheles. One dwelling was included in this area, and it seemed to be as free from Anopheles as the privies and other buildings."

The simulid or black-fly pest, J. WILHELMI (*Die Kriebelmückenplage. Übersicht über die Simuliidenkunde, Besonders in Praktischer Hinsicht. Jena: G. Fischer, 1920, pp. 246, figs. 23*).—This is an account of the Simulidæ considered under the headings of classification, nomenclature and terminology, morphology and anatomy of adults, geographical distribution, ecology and biology of adults and immature stages, injury, development, etc. A report by

Nevermann and Wilhelmi on a council regarding the control of this pest held in the Ministry of Agriculture; a bibliography of 26 pages, chronologically arranged; and an index are included.

Synopsis of the dipterous family Psilidæ, A. L. MELANDER (*Psyche, 27 (1920), No. 5, pp. 91–101*).—Thirty-eight forms are recognized as occurring in North America, of which nine species are described as new.

A new scolytid beetle from tropical Florida, E. A. SCHWARZ (*Ent. Soc. Wash. Proc., 22 (1920), No. 8, pp. 222–226, figs. 2*).—*Dendrosinus bourreriæ,* found boring in *Bourreria havanensis* at Marathon, Vacas Key, Fla., is described as new.

The cigar leaf roller, an enemy of pear, P. PASSY (*Rev. Hort. [Paris], 92 (1920), No. 8, pp. 145, 146, fig. 1*).—A brief account of *Rhynchites conicus* and its injury.

Four Rhynchophora attacking corn in storage, R. T. COTTON (*Jour. Agr. Research [U. S.], 20 (1921), No. 8, pp. 605–614, pls. 4*).—This paper, dealing with the coffee-bean weevil, the broad nosed grain weevil (*Caulophilus latinasus* Say), the rice weevil, and the granary weevil, presents drawings of their immature stages, together with descriptions and keys, by reference to which the various species may be readily distinguished in whatever stage they may be found.

Division of bee culture, F. JAGER (*Minnesota Sta. Rpt. 1920, p. 39*).—This is a brief statement of work under way. Analysis of the food carried into the hive by bees indicates that ordinary flour can never be substituted for pollen. Gluten, being higher in protein content, may yet show positive results.

Nineteenth annual report of the Illinois State Beekeepers' Association, G. M. WITHROW (*Ill. Beekeepers' Assoc. Ann. Rpt., 19 (1919), pp. 208, figs. 12*).—The proceedings of the annual meeting of the association in 1919 are presented.

New predacious and parasitic mites of the superfamily Gamasoidea (Acar.), H. E. EWING (*Ent. News, 31 (1920), No. 10, pp. 286–293, figs. 11*).—Eleven species are described as new to science. Some of the predacious forms described are of considerable benefit because of their attacks upon injurious insects.

On Coccobacillus insectorum Hollande and Vernier, A. PAILLOT (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 8, pp. 442, 443*).—The author disagrees with the views of Hollande and Vernier expressed in the article previously noted (E. S. R., 43, p. 853), in which they place other forms under *C. insectorum.*

Some notes on the Arthropods of medical and veterinary importance in Mesopotamia, and on their relation to disease, W. S. PATTON (*Indian Jour. Med. Research, 7 (1920), No. 4, pp. 735–777, pls. 5, figs. 8*).—The first part of this paper relates to the gadflies of Mesopotamia (pp. 735–750) and the second part to Mesopotamian house flies and their allies (pp. 751–777.)

FOODS—HUMAN NUTRITION.

Growth and reproduction upon simplified food supply, H. C. SHERMAN, M. E. ROUSE, B. ALLEN, and E. WOODS (*Soc. Expt. Biol. and Med. Proc., 17 (1919), No. 1, pp. 9, 10*).—In this preliminary note the authors report briefly the results obtained in feeding rats with bread alone and with bread supplemented by milk or by single articles of food, the experiment in each case being started at the time of weaning of the animals.

Rats fed on white bread made without milk or butter ceased to grow and died in about 6 weeks. With bread and meat there was some growth at first, but the animals lived only slightly longer than on the bread diet; with bread and

apple there was no growth but a prolongation of life; with bread and turnip slow growth; and with bread and milk in equal parts by weight continuous growth at a normal rate. The males, on this diet, were capable of normal reproduction, but the females usually failed to breed and seldom raised their young.

With the substitution of whole wheat instead of white bread the young were successfully suckled and grew at somewhat less than the normal rate. By increasing the milk to furnish two-fifths instead of one-fifth of the total calories, the rest being furnished by whole wheat, normal growth and reproduction were obtained. The substitution of dried milk for the market milk caused the same results, indicating that no loss in A or B vitamin had taken place in the drying of the milk.

Baking in the home, H. L. WESSLING (*U. S. Dept. Agr., Farmers' Bul. 1136, pp. 40, figs. 8*).—This publication, which was prepared in cooperation with the Office of Home Economics, discusses factors which must be considered and methods for bread making. Recipes are also given for a considerable number of different sorts of rolls, pastry, and cookies, and quick or hot breads, such as biscuits, muffins, gems, griddle cakes, and the like.

Attention is paid to the possibilities of using corn, rye, barley, buckwheat, rice, potatoes, and similar foodstuffs to replace part of the wheat in household baking.

The proteoclastic enzyms, H. E. WEAVER and J. C. WOOD (*Jour. Amer. Assoc. Cereal Chem., 5 (1920), No. 2, pp. 6–11*).—The authors have studied the effect of proteoclastic enzyms in old flour to find what effect they may have on wheat in storage and upon the decomposition of gluten both in the flour and in the dough. The investigations reported included demonstrations of the presence of such enzyms, and also the results of a study of the effect of enzyms upon the quality of bread when added to the flour before fermentation. The enzyms used were diastase, pepsin, trypsin, pancreatin, steapsin, and rennin, of which diastase and trypsin are known to occur in flour.

The conclusion is reached that the proteoclastic "enzyms may be greatly stimulated while still in the wheat; in fact, they increase to the extent that bread can no longer be made from the flour. However, when used in small proportions they act beneficially to the baking, and especially is this true with flour from a new crop that has not aged. We have shown that so small an amount as 0.02 per cent will completely ruin a dough, while the use of 0.001 per cent acts as an improver and shows a saving in yeast. It may be entirely possible that a slight increase of enzyms is the responsible factor between the difference in baking qualities of old and new wheat flour. . . . In some previous work, using new flour, quite an improvement was shown by using a mixture of trypsin and diastase, also by the addition of malted flour.

Digestibility of germinated beans, D. M. ADKINS (*Biochem. Jour., 14 (1920), No. 5, pp. 637–641*).—A study in vitro of the digestibility of the proteins of three varieties of beans, ungerminated and germinated, is reported.

In a series of 29 experiments the increase in nitrogen digestibility of the germinated over the ungerminated beans varied from 15.3 per cent when the beans were germinated rapidly to 4.3 per cent on slow germination. Drying the germinated beans even partially again decreased their digestibility, the increase in nitrogen digestibility of dried germinated beans over ungerminated varying from 7.8 to 1.2 per cent, according to the rapidity with which drying occurred.

Peppers (*U. S. Dept. Agr., Dept. Circ. 160 (1921), pp. 10, figs. 4*).—This circular, which has been prepared for girls' club work with Spanish peppers, consists of instructions by W. W. Tracy, of the Bureau of Plant Industry, on grow-

ing pepper plants, followed by directions for canning peppers, recipes for stuffed pepper mango, Dixie relish, and B. S. (Banner of Spain) chutney, and suggestions for the use of fresh and canned peppers.

Food value of candy (*California Sta. Rpt. 1920, pp. 70, 71*).—The composition and fuel value of 10 varieties of candy as calculated by M. E. Jaffa from moisture determinations and formulas for the different varieties as submitted by the manufacturer are reported. The lowest fuel value per pound was 1,550 calories for marshmallows and the highest 2,158 for peanut brittle.

Nutritional worth of ripe olives, M. E. Jaffa (*Calif. State Bd. Health Mo. Bul., 16 (1920), No. 3, pp. 51, 52*).—From a summary of data and a discussion of available information, the author concludes that the ripe, or mature, olive is a valuable, palatable, and easily digestible form of food, and should be considered a food and not a food accessory or condiment.

[Olive investigations] (*California Sta. Rpt. 1920, pp. 48, 49*).—This report, continuing previous work (E. S. R., 42, p. 805), deals principally with investigations conducted by W. V. Cruess to insure against the occurrence of *Bacillus botulinus* in canned olives.

It was found that Mission olives withstand temperatures up to 250° F. for 30 minutes and Manzanillo and Sevillano varieties up to 240° for the same length of time without serious injury to quality. At high temperatures olives which have been given a light lye treatment in pickling develop a bitter flavor, while those which have been given a more severe lye treatment do not develop this flavor. Any scorched flavor caused by high temperatures is said to diminish rapidly during storage. The higher the salt concentration of the brine the less is the flavor injured by high temperatures. The maximum concentration of brine which does not cause the olives to taste too salty (6 per cent) is, however, below the concentration sufficient to prevent growth of *B. botulinus*. Olives canned in brines of various degrees of acidity proved unsatisfactory in the case of citric and acetic acids in 0.3 per cent concentration, but lactic acid up to 0.5 per cent gave a fairly good product. A tendency to bleach was noted in some but not all olives sterilized at 250°.

The necessity of sterilizing olives at a temperature of from 240 to 250° was indicated by experiments performed by Beresford and Mead, who found that olives from commercial plants which heat the canned fruit to from 190 to 212° usually contain living organisms of spore-bearing types. Olives sterilized at from 240 to 250° were in most cases free from living organisms.

Olive pickling and sterilizing experiments, W. V. Cruess (*Calif. State Bd. Health Mo. Bul., 16 (1920), No. 3, pp. 45–50, figs. 2*).—From the experimental data reported, the author concludes that "standing solutions containing more salt than has in the past been customary should be employed for shipping and storing unpickled olives.

"The pickling process should be as rapid as is compatible with the production of satisfactory pickled fruit. Frequent or continuous aeration of the liquids used in pickling is desirable. Long storage of the pickled fruit in dilute brines is very undesirable and is unnecessary.

"A temperature of 240° F. for 40 minutes did not materially injure the quality of ripe olives of the Mission, Manzanillo, and Sevillano varieties. All samples examined after processing at 240° F. for 30 minutes or at 250° F. for 15 minutes were sterile."

Scientific methods of processing and packing the California ripe olive, F. Simmonds (*Calif. State Bd. Health Mo. Bul., 16 (1920), No. 3, pp. 40–44, figs. 4*).—The stage of ripeness, processing, canning equipment, canning procedure, sterilization, and other questions are discussed in relation to commercial practice.

The distribution of the spores of Bacillus botulinus in nature [its relation to the contamination of fruits and vegetables and to canning], K. F. MEYER and J. C. GEIGER (*Pub. Health Rpts.* [*U. S.*], *36* (*1921*), *No. 1, pp. 4–6*).—This paper summarizes information regarding the relative frequency and distribution of botulism in California, including outbreaks with fowls and horses as well as with man.

It appears that, so far as the Pacific coast is concerned, a tendency to a distinct centralization is noted. The occurrence of botulism cases is not confined to certain districts or counties, but may, in a manner characteristic for soil-borne infections, be restricted to certain streets or sections of a city or village. . . . Not infrequently forage poisoning cases in horses antedated the observation of human or bird cases. In some of these localities the spores of *B. botulinus* have been demonstrated in decomposed hay, straw, or similar material which served as food for the horses.

"Outbreaks among chickens or barnyard birds are always closely connected with the feeding of spoiled vegetables or food, and they are therefore not infrequently associated with human cases. The recognition of the intoxication under the collective term of 'limberneck of chickens' serves sometimes as a guide in locating the source of poisoning. One may suspect that the soil of certain parts of the Pacific coast is or has become polluted with botulism spores through the use of manure or other fertilizing material.

"Peas, beets, radishes, asparagus, carrots, parsnips, and string beans, bought in the open market in San Francisco and neighboring towns, revealed by cultural methods the presence of *B. botulinus* spores. . . . The information thus far at hand . . . definitely indicates that the spores of *B. botulinus* may be widely distributed in nature in certain localities, and that they may be on vegetables or fruits when they are picked or bought in the open market."

The prevention of botulism from canned foods, E. C. DICKSON (*Calif. State Bd. Health Mo. Bul.*, *16* (*1920*), *No. 3, pp. 36–38*).—The author points out that the prevention of botulism "depends not upon curtailing the use of home canned or commercially canned foods, but upon the education of those who use canned foods as to the possible danger which may accompany their use and the methods for avoiding those dangers.

"No canned food, or indeed any food, which shows the slightest sign of spoilage, whether in appearance or odor, should be served as food, or should be tasted to see whether it is good. No canned foods which have not been processed at high temperatures should be served or tasted without having been thoroughly cooked after they are removed from the container; this is especially applicable to vegetables of the types which are frequently served as salads."

Ammonia excretion, amino acid excretion, and the alkaline tide in Singapore, J. A. CAMPBELL (*Biochem. Jour.*, *14* (*1920*), *No. 5, pp. 603–614, figs. 3*).—Studies on the nitrogen metabolism in Singapore previously noted (E. S. R., 43, p. 65) have been extended to include determinations of the hourly variations in ammonia excretion and their significance, together with observations on the excretion of amino acids and the reaction of the urine.

The hourly excretion of ammonia, both in subjects excreting a normal amount and also in those excreting larger amounts, was found to vary widely with the same subject, any subject being likely to show an increase lasting from one to several days. The ammonia excretion varied inversely as the acidity of the stomach and directly as the acidity or inversely as the alkalinity of the urine. The largest daily amounts of ammonia noted in all subjects were excreted by the individuals most exposed to the effects of the climate, thus indicating that the climate is responsible for a certain degree of acidosis.

Other points noted were the general occurrence of well-marked alkaline tides three hours after any meal, the direct variation of the volume of urine with acidity, a high total acidity in many cases, and a direct variation of the amino acids of the urine with the total nitrogen.

The nomenclature of the so-called accessory food factors (vitamins), J. C. DRUMMOND (*Biochem. Jour., 14 (1920), No. 5, p. 660*).—The author suggests that in place of the rather cumbersome terms fat-soluble A, water-soluble B, and water-soluble C, these substances be spoken of as vitamin A, B, and C, respectively.

On the relation of the lipochrome pigments to the fat-soluble accessory food factor, O. ROSENHEIM and J. C. DRUMMOND (*Lancet [London], 1920, I, No. 16, pp. 862–864*).—This discussion of the relation of the lipochrome pigments to fat-soluble A is based upon experimental evidence obtained by the authors and quoted from the literature.

The work of Palmer and Eckles on the occurrence of lipochromes in the animal body (E. S. R., 31, p. 273) is reviewed briefly, and attention is called to the correlation between the distribution of fat-soluble A and the lipochromes. The failure of lipochromes to serve as sources of fat-soluble A as previously noted by Drummond (E. S. R., 41, p. 559) is considered to justify the conclusion that the lipochrome pigments and fat-soluble A are not identical but not to refute the theory of a close relationship between them. In substantiation of this theory reference is made to the similar properties of both in existing in the form of a complex insoluble in the usual fat solvents until broken down by alcohol, and to the work of Steenbock and Boutwell on the relation of yellow pigments to the fat-soluble vitamin (E. S. R., 42, p. 461).

The recent papers by Palmer and Kempster on the relation of plant carotinoids to growth, fecundity, and reproduction of fowls (E. S. R., 44, p. 69) are discussed, and exception is taken to the assumption of these authors that pig's liver used in some of their experiments is free from lipochrome pigments. The authors state that they have found in liver tissue carotin and xanthophyll, and in addition a substance which gives certain reactions similar to those given by lipochromes, but which is not identical with any known member of this class. The opinion is advanced that the supplement of liver was actually providing the lacking pigment substance, and that consequently the results obtained support the idea that substances closely related to lipochromes are of importance in nutrition.

Researches on the fat-soluble accessory substance, III–V (*Biochem. Jour., 14 (1920). No. 5, pp. 661–677, figs. 4*).—In continuation of the researches on vitamin A (E. S. R., 41, p. 559) three papers are presented.

III. *Technique for carrying out feeding tests for vitamin A (fat-soluble A)*, J. C. Drummond and K. H. Coward (pp. 661–664).—The authors are of the opinion that discrepancies in the quantitative results reported by various workers in studies of vitamin A are due in large part to the very different types of dietaries used in various laboratories and to the size and age of the experimental animal, experience having shown that the amount of vitamin that must be supplied to a rat in order to restore growth which has been inhibited on a deficient basal diet is inversely proportional to the weight and age of the animal.

Certain improvements in the technique of the feeding experiments described in the second paper of this series are described. The basal ration as modified consists of purified caseinogen 18, purified rice starch 52, refined vegetable oil (usually cotton seed) 15, yeast extract 5, orange juice 5, and salt mixture 5 parts. The rice starch is used in place of wheat starch, as it has been found to be almost devoid of A in the crude state and thus more readily purified than

wheat starch. On this ration small rats of 50 to 70 gm. weight should show only slight initial growth, becoming stationary after a week or two. All substances to be examined for A are tested on rats, the growth of which has been suspended for from 10 to 14 days and which do not weigh more than from 80 to 120 gm. The substance is best tested by administering a definite weight directly to the animal before the day's ration of the basal food is given.

IV. *Nuts as a source of vitamin A*, K. H. Coward and J. C. Drummond (pp. 665-667).—Brazil nuts, Barcelona nuts, peanuts, walnuts, almonds, and butternuts tested by the method noted above were found to possess a relatively low value as sources of vitamin A, although rich in fats. None of the 18 rats used as experimental animals increased perceptibly in weight during the 32 days of the experiment in which 1 gm. of the nut was fed daily. Five of the rats developed a bad form of the characteristic eye disease associated with lack of A.

The nuts were also tested for carotin and xanthophyll. In no case was more than a mere trace of pigment found, and this failed to give characteristic lipochrome reactions.

"These results furnish additional evidence for the theory that vitamin A is formed in the green part of the living plant and is not stored to any appreciable extent as such in the seed and other resting tissues."

V. *The nutritive value of animal and vegetable oils and fats considered in relation to their color*, J. C. Drummond and K. H. Coward (pp. 668-677).—In view of the recent discussion concerning the possible relationship between vitamin A and yellow coloring pigments, a large number of animal and vegetable oils were tested both for the presence of vitamin A and for the presence and nature of the accompanying pigments.

The butter tested included samples of the darkest and palest butters from a butter-making contest, a sample of average color, and also samples made from cream from a cow after 1 and 2 weeks, respectively, on a winter feed of mangolds, hay, and cottonseed cake, and after 2 weeks on pasture. Of the last three samples the one representing 2 weeks of winter feed was of the lightest color. The feeding experiments were conducted on rats, as described in the third paper of the series, 3 per cent of butter being substituted for the larger amount of hardened fat in the basal ration.

The five samples of butter proved to be of approximately the same value as regards vitamin A, with the exception of the 2 weeks' winter feed sample, which was of slightly lower value. The figures representing the amount of pigments present, as derived from colorimetric estimations made upon the unsaponifiable fraction from 10 gm. of the oil varied, however, from 30 in the case of highly colored samples to 2.5 in the winter feed sample. Two samples of horse fat, one from a stable-fed and the other from a grass-fed animal, had practically the same value as regards vitamin A, from 6-7 and 6-8, based on average butter as 10, while the amount of pigment in the latter was 65 times that of the former. Dog-body fat, mutton fat, and perinephritic pig fat had appreciable amounts of A but no pigment. A very dark sample of palm oil had a vitamin A value of 3-4, a bright yellow sample of corn oil 2-3, and an average sample of cottonseed oil 1. The sample of palm oil was nearly twice as rich in pigment as was the corn oil.

The authors conclude that while as a class the animal fats possess a growth-promoting power superior to that of the vegetable oils, no hard and fast line can be drawn between them. The results reported are also thought to indicate that the frequent association of vitamin A with pigments of the lipochrome class must be regarded as accidental.

A comparison of the influence of secretin and the antineuritic vitamin on pancreatic secretion and bile flow, C. Voegtlin and C. N. Myers (*Jour.*

Pharmacol. and Expt. Ther., 13 (1919), No. 4, pp. 301–315, figs. 8).—In this paper the authors present evidence which suggests that possibly the antineuritic vitamin and secretin are identical.

Purified yeast extracts showing activity in relieving antineuritic symptoms of pigeons caused an increase in pancreatic secretion and bile flow when injected intravenously into dogs, while a yeast extract which had lost its curative powers failed to stimulate pancreatic secretion and bile flow, although it still possessed depressor action upon blood pressure. Secretin solutions obtained from the duodenum of hogs were able to relieve, temporarily at least, the neuritic symptoms of pigeons. It is also pointed out that secretion and the antineuritic vitamin resemble each other in that both are found in the same fractions, both lose their activity on chemical purification, and both are absorbed by Lloyd's reagent and can be recovered from that agent by suitable treatment with alkali.

Note on scurvy in pigs, R. H. A. Plimmer (*Biochem. Jour., 14 (1920), No. 5, pp. 570, 571*).—The author reports typical cases of scurvy in four young pigs which had been fed entirely on cooked food, a mash composed of meal, sharps, and turnips. On changing to the same diet in the raw state, supplemented by an increase in the fresh turnip ration, return to health with renewed growth took place.

ANIMAL PRODUCTION.

Correlation and causation, S. Wright (*Jour. Agr. Research [U. S.], 20 (1921), No. 7, pp. 557–585, figs. 16*).—The author points out that the coefficient of correlation and the correlation ratio are purely descriptive statistical determinations and imply nothing as to the relationship between the correlated variables. However, in many cases there are experimental or other grounds for assuming that variations in certain of the quantities measured are due wholly or in part to variations in other measurable quantities. The main purpose of this paper is to present a method whereby the relative importance of the different causes of variation can be estimated, provided there are a sufficient number of pairs of causes, pairs of effects, and pairs of cause and effect whose correlation can be determined.

If M and N are two correlated causes completely determining by their sum an effect X, it is known that the relationship between the standard deviations (σ) of the three variables may be expressed by the equation:

$$\frac{\sigma_M^2}{\sigma_X^2}+\frac{\sigma_N^2}{\sigma_X^2}+2\frac{\sigma_M\sigma_N}{\sigma_X^2}r_{MN}=1,$$

where r_{MN} is the coefficient of correlation between M and N. The author calls the three quantities to the left of this equation the coefficients of determination of X and assigns them the symbols $d_{X\cdot M}$, $d_{X\cdot N}$, and $d_{X\cdot\overline{MN}}$, respectively. In general $d_{X\cdot A}$ is the fraction of the total variation (mean square deviation) of X that is due to A exclusively, and $d_{X\cdot\overline{AB}}$ is the fraction due to the effect of A and B acting jointly. The sum of the d's is always unity.

Closely related to the coefficient of determination is another function, the path coefficient, whose type symbol is $p_{X\cdot A}$. It measures the direct influence of A on X, and is so named because in diagrams the connection between the two can be represented as a line or path. In the special case of two correlated causes,

$$p_{X\cdot M}=\sqrt{d_{X\cdot M}} \text{ and } d_{X\cdot\overline{MN}}=2p_{X\cdot M}p_{X\cdot N}r_{MN}.$$

The path coefficient shows a number of formal resemblances to the coefficient of correlation.

If two effects, X and Y, are completely determined by the correlated causes M and N, it is shown that

$$r_{XY}=p_{X\cdot M}p_{Y\cdot M}+p_{X\cdot M}r_{MN}p_{Y\cdot N}+p_{X\cdot N}p_{Y\cdot N}+p_{X\cdot N}r_{MN}p_{Y\cdot M},$$

and if X and Y have the uncorrelated causes A, B, C, etc., in common

$$r_{XY}=p_{X\cdot A}p_{Y\cdot A}+p_{X\cdot B}p_{Y\cdot B}+p_{X\cdot C}p_{Y\cdot C}+\cdots$$

Since path correlations may be negative, these equations show that two quantities may be entirely uncorrelated and yet be completely determined by the same set of conditions. In the case of two proximate causes, M and N, each determined in part by a more remote cause B not correlated with other remote causes, their path coefficients are connected by the relationship

$$p_{X\cdot B}=p_{X\cdot M}p_{M\cdot B}+p_{X\cdot N}p_{N\cdot B}.$$

The equations noted are sufficient for the analysis of the simpler forms of causation. Indications of how to treat cases of nonadditive causes and suggestions for expressing correlation in terms of determination are included.

As a simple illustration of the method, the author cites data on the birth weight of guinea pigs collected in the course of his breeding experiments in the Bureau of Animal Industry, U. S. Department of Agriculture. Using only three coefficients of correlation, viz, between birth weight and length of gestation period, between birth weight and size of litter, and between gestation period and size of litter, it was found that variations in the rate of prenatal growth are responsible for 74.42 per cent of the variation (mean square deviation) of the birth weight, and variations in the length of gestation are responsible for 10.69 per cent. Variations in size of litter produce 35.3 per cent of the variation in prenatal growth, 19.75 per cent of the variation in duration of pregnancy, and 43.27 per cent of the variation in birth weight. Unknown causes not correlated with litter size and affecting growth alone produce 48.15 per cent of the variation in birth weight, and unknown causes influencing gestation period but independent of litter size produce 8.58 per cent of this variation. These results were secured without the necessity of making any assumption as to the nature of the prenatal growth curve or the causes other than litter size which affect prenatal growth and the length of gestation.

As a more elaborate illustration, the author analyzes the factors causing transpiration in plants, using the data collected by Briggs and Shantz (E. S. R., 36, p. 225).

Inheritance of syndactylism, black, and dilution in swine, J. A. Detlefsen and W. J. Carmichael (*Jour. Agr. Research* [*U. S.*], *20* (*1921*), *No. 8, pp. 595–604, pl. 1*).—Six F_1 sows of a cross between a black mule-foot boar and Duroc-Jersey sows were acquired by the Illinois Experiment Station and used in breeding experiments.

About 250 F_1 individuals were observed on the farm where the cross was made and were found to be uniformly syndactylous and self-black. The F_1 sows mated to a Duroc-Jersey boar produced 8 black mule-foot offspring, 11 black cloven-foot, 9 red mule-foot, and 14 red cloven-foot. Further experiments in which the offspring were mated together confirmed the inference that mule-foot and cloven-foot form one pair of allelomorphs, black and red another; that mule-foot and black are completely dominant to their respective allelomorphs, and that the two factors are independent of each other and are not sex linked. The "reds" ranged in color from a typical Duroc-Jersey red through shades of yellow to a pale cream which was practically a white in the case of new-born pigs. The matings yellow×yellow and cream×cream both gave rise to creams, yel-

lows, and intense reds, and this leads the authors to the view "that there is an interaction of factors producing intensity of red and that similar somatic creams are not necessarily of the same genetic constitution." These inhibiting factors do not affect black. The cream color resembled the color of Berkshires and Chester Whites, even in microscopic appearance.

Corn stover silage investigations, J. M. SHERMAN and S. I. BECHDEL (*Pennsylvania Sta. Rpt. 1917, pp. 348–359*).—A brief report of these investigations has been noted (E. S. R., 38, p. 270). It was found that the acid-producing bacteria, particularly those coagulating milk in cultures, increased steadily during the first 12 weeks after the corn stover was ensiled, whereas the casein-digesting bacteria, the alkali formers, and the organisms classified as inert disappeared. The fact that experimental stover silage preserved with ether continued to undergo acid fermentation, whereas autoclaved stover reinoculated with raw silage juice and sealed did not undergo the typical fermentation, is cited in support of the cell respiration theory of silage formation.

Sugar beet top silage, R. E. NEIDIG (*Jour. Agr. Research* [*U. S.*], *20* (*1921*), *No. 7, pp. 537–542*).—This is a report of the chemical composition of 10 samples of beet-top silage collected by the Idaho Experiment Station from farms in sugar-beet districts. None of the samples were considered of good quality, and 7 were graded poor. Dirt formed up to 18 per cent of the material. The moisture content varied from 49.5 to 81.5 per cent, the protein from 1.38 to 6.51, and the crude fiber from 1.1 to 3.44 per cent. Acidity determinations on 7 samples indicated definitely that the fermentations were different from those in corn silage. In only one case was butyric acid absent, and except in this and one other sample the amount of lactic acid was distinctly below the total of the volatile acids.

Kaolung (*California Sta. Rpt. 1920, p. 71*).—Kaolung, or grape seed oil meal, was found to have the following composition: Water 9, crude protein 12.78, fat 6.7, fiber 37.05, nitrogen-free extract 31.95, ash 2.52, and tannin 1.25 per cent. It is noted that nearly 40 per cent of the material is crude fiber, indicating in this case mainly the shell of the seed, which has practically no food value.

Record of body measurements of steers, B. O. SEVERSON, P. GERLAUGH, and F. L. BENTLEY (*Pennsylvania Sta. Rpt. 1917, pp. 296–316, pls. 5*).—Tables are presented similar to those previously noted (E. S. R., 43, p. 570) giving the individual body measurements (22 dimensions) of 60 steers used in experiments during 1916–17, both at the beginning and at the end of the feeding periods. A brief report of the results of the feeding trial has been noted (E. S. R., 38, p. 270).

A statistical study of body weights, gains, and measurements of steers during the fattening period, B. O. SEVERSON and P. GERLAUGH (*Pennsylvania Sta. Rpt. 1917, pp. 275–295, pls. 10*).—The authors present tables showing the correlation between the gain of steers in 140-day feeding trials and the measurements of individual body dimensions at the beginning of the trial, and also the correlation between gain and increase in girth and the mutual correlations of certain other measurements. The data were secured from the feeding experiments of 1914–15, 1915–16, and 1916–17, and most of the tables are based upon 142 steers.

The coefficient of correlation between initial heart girth and gain was 0.238, between girth in front of hips and gain 0.221, between width at thurls and gain 0.224, and between length of pelvis and gain 0.271. In each of these cases the probable error was 0.053 or 0.054. The correlations were lower in the case of the other measurements, including the width at shoulders, depth of chest, length of head, and middle girth. The increases in circumference were more highly

correlated with the gains, particularly the increase in heart girth, where the correlation was 0.460±0.044.

Cattle feeding investigations, 1919–20, C. W. McCampbell and H. B. Winchester (*Kansas Sta. Circ. 86 (1921), pp. 11, fig. 1*).—Most of this circular is a report on a cattle-feeding experiment designed to determine the value of a heavy silage ration with little or no corn. There were 3 lots of four-year-old steers that were fed for 130 days and 1 lot of yearlings and 2 lots of calves fed 210 days. For purposes of more detailed comparison the records of the first 120 days of 3 of the lots are also tabulated. The basic ration consisted of linseed meal or cottonseed meal (2.5 lbs. per head), cane silage, and alfalfa hay. Modifications of this ration and the main results are indicated in the following table:

Utilization of silage by cattle of various ages.

Lot.	Initial weight per head.	Feeding period.	Feeding methods	Final weight per head	Daily gain per head.	Consumed per pound of gain				Shrinkage.	Dressed weight.
						Shelled corn.	Oil meal.	Cane silage	Alfalfa hay.		
	Lbs.	*Days.*		*Lbs.*	*Lbs.*	*Lbs.*	*Lbs*	*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*
1	988	130	Corn last 45 days	[1] 1,156	1.29	2.40	1.95	33.0	2.31	4.6	57.5
3	987	130	No corn	[1] 1,131	1.11	......	2.26	43.4	2.69	6.0	57.4
		120	do	1,209	1.85	......	1.36	26.1	1.61	......	......
4	638	120	do	855	1.82	......	1.33	18.4	1.62	......	......
		210	Corn last 90 days	[1] 961	1.54	2.83	1.60	16.2	1.85	2.9	55.3
5	398	120	No corn	586	1.57	......	1.57	12.4	1.82	......	......
		210	Corn last 90 days	[1] 745	1.65	2.41	1.54	8.4	1.71	4.5	55.1
6	399	210	Corn throughout	[1] 814	1.98	4.54	1.27	4.5	1.46	3.6	57.5

[1] Selling weight at Kansas City. Time in transit is included in the feeding period.

The aged steers were classified as killers, the yearlings as feeders, and the calves as stockers at the end of the 120 days' feeding on a "heavy silage, no corn" ration. The additional 90 days' corn feeding caused the calves (lot 5) to develop into satisfactory baby beef.

The results from lot 2 (fed like lot 1 but with molasses in place of corn) are thought to indicate that molasses compares favorably with corn as a supplement to silage and alfalfa, but its use is not recommended owing to the difficulty in handling it in the winter.

In another experiment 40 steer calves were divided into 2 main groups, 1 fed alfalfa hay cut at different stages and the other corn silage or cane silage with 1 lb. of cottonseed meal per head per day. The experiment lasted 90 days and the initial weight per steer was about 440 lbs. The calves fed alfalfa made an average daily gain of 0.73 lb., and those fed silage gained 1.05 lbs. per head daily.

The maintenance of a beef-breeding herd, November 25, 1914, to July 18, 1917, B. O. Severson (*Pennsylvania Sta. Rpt. 1917, pp. 127–211, pls. 32*).—This is the detailed report of the fourth, fifth, and most of the sixth year of a project begun in 1911. Reports for previous years have been noted (E. S. R., 38, p. 69). The data tabulated include the individual weights and feeding records of the 10 Shorthorn and the 10 Angus cows in each lot, the growth and feeding records of the heifers, the feed consumption of the steer calves fattened, and the feed cost of maintaining the herd bulls. Proximate analyses (including in some cases determinations of reducing sugar, pentosans, and ammoniacal nitrogen) of the cottonseed meal, linseed meal, and corn silage fed are also given.

Corn silage as the sole roughage for the breeding cows was found to be entirely satisfactory during the three winters. Only 3 calves were lost out of

the 59 dropped. Cottonseed meal was fed to the Angus cows during these winters and linseed meal to the Shorthorns, but no practical difference in the value of the two feeds was observed. The Shorthorn cows averaged a loss in weight of 30 lbs. per head during the three winters and the Angus cows a loss of about 8 lbs. The calf crop was 57 per cent in the case of the Shorthorns and 78 per cent in the case of the Angus. The Shorthorns averaged 63.9 lbs. of silage per day during the winters and the Angus cows 65.6 lbs. During the fourth and fifth summers the Shorthorns averaged 67 lbs. gain and the Angus cows 73 lbs. The 23 Shorthorn calves averaged 74.55 lbs. at birth and the 36 Angus 72.48 lbs.

Studies in veal production, S. I. Bechdel (*Pennsylvania Sta. Rpt. 1917, pp. 337–347, pls. 3*).—An experiment in feeding veal calves is reported. Eleven were fed on whole milk alone, 10 received proprietary calf meals as a partial substitute for whole milk, and 4 received skim milk and a grain mixture. The feed consumption and the detailed slaughter records of the individual calves are tabulated.

There was considerable variation in the feeding period. The whole-milk calves were fed for an average of 53 days, made a daily gain of 1.85 lbs. per head, and required 9.4 lbs. of milk per pound of gain. The average feeding period of the remaining calves was 63 days, including 32 days on whole milk, and the daily gain averaged 0.93 lb. The calves receiving the milk substitutes made inferior veal, bringing only 5.56 cts. per pound, whereas the price received for the whole-milk calves averaged 9.74 cts. per pound. As a result, it is considered inadvisable to feed veal calves on anything except whole milk.

A study in crossbreeding Delaine Merino ewes with mutton rams and crossbred rams of the F_1 generation, B. O. Severson (*Pennsylvania Sta. Rpt. 1917, pp. 212–268, pls. 21*).—This is the detailed report of the weights, feed consumption, and wool production of the ewes and lambs during the first two years of a crossbreeding experiment begun in November, 1915. A summary of the results of the first four years has been noted from Bulletin 163 (E. S. R., 44, p. 72).

Pasturing sheep [at the Huntley, Mont., Reclamation Project Experiment Farm], D. Hansen (*U. S. Dept. Agr., Dept. Circ. 147 (1921), pp. 23, 24, fig. 1*).—The usual sheep pasturing test (E. S. R., 43, p. 465) was modified in 1919 by using a different pasture, a 1.4-acre plat of white clover and blue grass. During the 146 days of the grazing season an acre of this pasture carried an average of 5 ewes and 9 lambs. The ewes gained 96 lbs. and the lambs 424 lbs. per acre.

Expěriment on fattening lambs for market, B. O. Severson (*Pennsylvania Sta. Rpt. 1917, pp. 269–274*).—Three lots of 10 wether lambs averaging about 64 lbs. in weight were fed for 56 days beginning October 2, 1916. All received a ration of 1.55 lbs. of a grain mixture (corn and linseed meal, 4:1). Lot 1 received mixed hay twice a day, lot 3 mixed hay in the morning and corn silage in the evening, and lot 2 received in the evening half as much silage as was consumed by lot 3, together with mixed hay morning and evening. Lot 1 gained 18.5 lbs. per head during the feeding period, lot 2 18.15, and lot 3 20.85 lbs. The gains in lot 1 were more variable than in the other lots, and from an inspection of the individual growth records it was found that the lighter-weight lambs did not grow as much as the lambs of similar weight fed the silage rations.

[Swine feeding at the Huntley, Mont., Reclamation Project Experiment Farm], D. Hansen and R. E. Gongwer (*U. S. Dept. Agr., Dept. Circ. 147 (1921), pp. 13–23, figs. 2*).—Records of the utilization by hogs of the crops in irrigated rotations in 1919 and the results of several swine-feeding experiments

involving the use of barley are reported. The experiments follow the general plan of those reported for previous years (E. S. R., 43, p. 465), and the past results in the long-term experiments are also summarized.

Duroc-Jerseys were used in the feeding experiments. In a 28-day experiment, beginning July 7, 50 fall pigs previously on alfalfa pasture were divided into 6 lots, 4 of which were fed in the dry lot. A comparison between corn and barley when supplemented with skim milk, afforded by lots 1 and 2, showed that 0.94 lb. of corn was equal to 1 lb. of barley. With the barley and skim milk ration there was produced 1.74 lbs. of gain per head daily, and with the corn and skim milk ration 1.68 lbs. Lot 3 fed barley and tankage (10:1) gained at the rate of 1.54 lbs. a day and required 4.32 lbs. of concentrates per pound of gain. Lot 4 fed barley alone made a gain of 1.44 lbs. per day and required 4.46 lbs. of grain per pound of gain. Lots 5 and 6 were continued on alfalfa pasture, but were not exactly comparable with the others, as the pigs were undersized. Lot 5 received barley as a supplement, made a gain of 1.16 lbs. per head daily, and required 4.65 lbs. of grain per pound of gain. Lot 6 received barley and tankage (10:1), gained 1.13 lbs. per day, and required 4.84 lbs. of concentrates per pound of gain—a result thought to indicate that tankage is unnecessary with a ration of barley when the pigs have access to alfalfa pasture.

In an experiment begun May 15, 2 lots of 11 hogs each were kept on quarter-acre plats of alfalfa for 35 days. Lot 1, fed barley, gained at the rate of 1.26 lbs. per head daily and lot 2, fed corn, gained 1.59 lbs. The former consumed 4.59 lbs. of grain and the latter 3.51 lbs. per pound of gain.

In a comparison between corn and barley for brood sows with suckling pigs it was found that both in the dry lot and on alfalfa pasture the barley ration seemed to maintain a more uniform weight in the sows and produced cheaper growth of the pigs.

The usual test of spring pigs on alfalfa pasture was augmented by a study of barley rations in addition to corn. Eight lots of 8 pigs each were placed on pasture on June 17 for a period of 99 days. At the end of the feeding period 6 representative pigs from each lot were fed in dry lot until they reached a marketable weight. The methods of feeding and the main results are given in the following table:

Results of a 99-day test of alfalfa pasture with spring pigs, followed by a dry-lot finishing period on barley and tankage (10:1) and alfalfa hay.

Lot number.	Grain ration on pasture.	Initial weight per head	Gain on pasture.		Weight at start in dry lot.	Finishing period.	Daily gain in dry lot.	Final weight per head.	Grain fed per pound of gain.		
			Per day per head.	Per acre.					Pasture period.	Dry lot period.	Entire experiment.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Days.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
7	None	40.5	0.128	[1] 202	56.7	105	1.36	200.0	......	5.33	4.89
1	Corn,[2] 1 per cent	40.1	.236	748	68.7	85	1.33	181.7	2.18	5.17	4.66
2	Corn,[2] 2 per cent	40.5	.313	992	78.2	73	1.48	186.6	3.54	5.10	4.75
3	Corn,[2] 3 per cent	40.2	.693	2,196	103.7	62	1.49	196.2	3.00	5.01	4.15
4	Corn,[2] self-fed	40.1	1.001	3,172	133.0	41	1.60	198.5	3.23	4.90	3.90
5	Barley, 1 per cent	41.0	.192	[3] 608	65.8	78	1.50	182.7	2.63	5.37	4.98
6	Barley, 2 per cent	40.8	.314	996	70.0	76	1.37	174.0	3.41	5.31	4.87
8	Barley, 3 per cent	40.6	.499	1,580	98.5	56	1.69	193.3	3.66	5.12	4.62

[1] Sixteen pigs to acre in lot 7; in other lots 32 to acre.
[2] Barley replaced corn after 56 days of pasture.
[3] Pasture not divided, while the other plats were.

A quarter-acre plat of alfalfa in each of two rotations furnished pasture for 5 fall pigs and 8 spring pigs in succession, the pigs being fed a 2 per cent corn ration. In rotation 67 the pasture lasted 159 days, the gains per acre were 2,476 lbs., the average daily gain per head was 0.57 lb., and 2.99 lbs. of grain were required for a pound of gain. In rotation 69 the grazing lasted 161 days, the total gain was 2,096 lbs. per acre, the daily gain per pig was 0.48 lb., and the grain consumed per pound of gain was 3.43 lbs.

In the hogging-off tests with spring pigs after the pasture season, a quarter acre of mature corn in rotation 67 supported 4 pigs for 27 days in the fall, producing pork at the rate of 24.1 lbs. per acre per day. On the basis of an estimated yield of 55 bu. of corn to an acre, 4.1 lbs. of grain were consumed per pound of gain. In rotation 69 a quarter-acre plat that had been seeded to Dwarf Essex rape in July supported 4 pigs from the alfalfa pasture for 29 days in the fall and produced pork at the rate of 48.06 lbs. per acre per day. The estimated yield of corn was 60 bu. an acre, and on this basis 2.41 lbs. of grain were consumed per pound of gain. When these results are averaged with those of previous years there appears a slight advantage in favor of the corn and rape.

In another experiment it was shown that the feeding of tankage to hogs in a cornfield was of no value in increasing the rate of gain or in reducing corn consumption per unit gain.

Full and limited feeding of fall pigs, W. L. Robinson (*Ohio Sta. Mo. Bul., 5 (1920), No. 11–12, pp. 274–280, figs. 3*).—The author reports three experiments in which full feeding of hogs in the dry lot was compared with limited feed.

In the first experiment a lot of hogs averaging 53.5 lbs. in weight was self-fed on corn and tankage for 14 weeks and attained a weight of 205.7 lbs. Another lot with an average initial weight of 45.2 lbs. was given a limited feed of corn and tankage (9:1) and free access to alfalfa hay. In the 14 weeks they attained a weight of 103.5 lbs. per head. The second experiment began December 14, 1917, and continued for 21 weeks. The initial weights were about 36 lbs. The pigs fed corn and tankage in a self-feeder weighed 194.3 lbs. at the end of the experiment. Those fed a 3 per cent ration of corn and tankage (9:1) weighed 150.3 lbs. and those fed a 2 per cent ration of corn and tankage plus alfalfa hay ad libitum reached the weight of 137.2 lbs. The third experiment was begun December 17, 1919, and continued 25 weeks. The average initial weight was about 44 lbs., and all the lots were hand-fed. The pigs on full feed of corn and tankage averaged 256.1 lbs. at the end of the trial. Those on a medium feed with alfalfa in addition weighed 171.7 lbs., and those on a light feed with alfalfa weighed 121.7 lbs.

Averaging the three experiments, it was found that the pigs on a full feed required 161 days to attain the market weight of 200 lbs. The average daily gain was 1.24 lbs. per head, and 3.7 lbs. of corn and 0.3 lb. of tankage were required per pound of gain. In each experiment the hogs that had a limited feed in the dry lot were continued on clover pasture (in one case for a short time on blue grass pasture) until they reached the weight of 200 lbs., receiving in each case the grain ration previously fed. On the average 279 days were required for the animals to attain a weight of 200 lbs. They made an average daily gain of 0.72 lb. and required 3.3 lbs. of corn, 0.24 lb. of tankage, and 0.99 lb. of alfalfa hay per pound of gain. In 1920 some of the hogs that had been fed on limited rations were given a full feed while on pasture. These attained the required weight in 253 days, made an average daily gain of 0.79 lb., and consumed 3.5 lbs. of corn, 0.27 lb. of tankage, and 1 lb. of alfalfa hay per pound of gain.

Taking into account the prolongation of the feeding period required when limited rations are used in feeding fall pigs and the consequent increase in overhead charges, labor, interest on investment, and risk, the author concludes that a full feed during the winter would in general be more economical.

Improving the quality of peanut-fed hogs by finishing in dry lot on corn and tankage; corn and cottonseed meal; corn and velvet beans, G. S. TEMPLETON (*Alabama Col. Sta. Bul. 213 (1920), pp. 81–96*).—Three feeding experiments are reported. In each a group of hogs were pastured on peanuts for 8 weeks, then most or all were transferred to the dry lot.

In the 1917 experiments 60 hogs were pastured and at the end of the grazing period they weighed 165 lbs. per head. They were divided into 4 lots, 3 of which were fed in the dry lot for 35 days. Lot 1 received corn and meat meal in a self-feeder for 2 weeks and corn and cottonseed meal (2:1) thereafter, and made a total gain of 47 lbs. per hog. The average melting point of the lard was 40.1° C. Lot 3 received corn and meat meal in a self-feeder for the entire period and made a total gain of 52.8 lbs. per head. The melting points of the lard averaged 38.24°. Lot 2 received corn and velvet beans (4.1) made a gain of 35.2 lbs. and produced lard which melted at 35.64°. The fourth lot was continued on peanut pasture and in the 5 weeks gained 35.8 lbs. per hog and produced oily carcasses with lard melting at 30.85°.

The 1918 experiment was made with 2 lots of hogs weighing about 156 lbs. at the end of the pasture trial. One lot was fed corn and tankage (60 per cent protein) and the other corn and a proprietary hog feed containing 40 per cent protein. Substantially the same gains were made by each lot, viz, about 75 lbs. per head in the 44 days of the test. The carcasses were classified as medium firm. The 1919 experiment was a duplicate of this, in which the 2 lots of hogs (150 lbs. per head) were fed 38 days. The tankage-fed hogs gained nearly 80 lbs. per head, while the other lot gained about 71.5 lbs. The lard of the tankage-fed hogs melted at 41.65°, and that of the hogs fed the proprietary feed melted at 40.1°.

[Soft pork investigations], J. C. GRIMES (*Alabama Col. Sta. Rpt. 1920, pp. 27, 28*).—To study the influence of peanut feeding on the carcasses and the lard, 6 lots of hogs were fed in Alabama for 101 days beginning March 20, 1920, and then shipped to the U. S. Experimental Farm at Beltsville, Md., where, after slaughter, the carcasses were graded and determinations made on the fat, with the following results.

Influence of peanut feeding (101 days) on carcasses and fat of hogs.

Lot.	Feeds offered.	Hogs fed.	Carcasses classified as—			Melting point		Iodin number.	
			Firm.	Medium.	Soft.	Leaf fat	Back fat	Leaf fat	Back fat.
						°C.	°C.		
1	Corn, tankage (8:1)	6	3	2	....	42.1	37.3	56.95	61.66
2	Corn, peanut meal (7:1)	6	4	2	....	40.1	36.3	56.69	63.21
3	Corn, peanut meal (2:1)	6	2	3	....	41.0	34.9	58.40	66.19
4	Corn, peanut meal (1:1)	6	3	2	....	40.2	36.3	61.98	66.49
5	Corn, peanut meal (free choice)	6	2	3	....	37.6	32.3	58.10	66.09
6	Whole Spanish peanuts	3	....	....	3	30.8	25.1	79.53	81.52

Feeding work horses, W. E. CARROLL (*Utah Sta. Circ. 43 (1920), pp. 18, fig. 1*).—This consists of practical suggestions for the economical feeding of farm horses.

Developing an American utility horse, J. O. Williams (*U. S. Dept. Agr., Dept. Circ. 153* (*1921*), *pp. 22, figs. 18*).—This is an account of the progress of a horse-breeding project begun in 1904 in cooperation with the Colorado Experiment Station at Fort Collins, Colo., and transferred in July, 1919, to the United States-Wyoming horse-breeding station at Buffalo, Wyo., which is conducted in cooperation with the State of Wyoming. The object is to develop a distinct breed of light utility horses from native American breeds, viz, the Morgan, the American Saddle horse, and in particular the Standardbred, which has furnished all the stallions and most of the mares. Eleven stallions are leased or available for lease to citizens for service on private herds or for community breeding. Two others, including the famous Standardbred stallion Carmon 32917 which headed the stud from 1904 until recently, are also allowed to serve a limited number of mares brought to the station. Descriptions and pedigrees are given of the stallions available for public service and also descriptions and breeding records of the foundation mares.

Stallion enrollment.—IX, Report of stallion enrollment work for the year 1920 with lists of stallions and jacks enrolled, R. B. Cooley (*Indiana Sta. Circ. 99* (*1921*), *pp. 80*).—This report of the Stallion Enrollment Board consists mainly of a directory of enrollments and renewals of the calendar year 1920, classified by counties. During the year there were enrolled 1,624 pure-bred stallions, 631 grade and scrub stallions, 822 registered jacks, and 333 grade and scrub jacks. With the exception of the registered jacks, these totals are all lower than in 1919 (E. S. R., 43, p. 269), but the proportion of pure-bred stallions is higher.

The effect on the storage of eggs of feeding cottonseed meal (*California Sta. Rpt. 1920, p. 78*).—It is stated that experiments by M. E. Jaffa indicate that cottonseed meal spots do not appear in eggs preserved by the water-glass method even when the cottonseed meal content of the mash was 3 per cent.

DAIRY FARMING—DAIRYING.

Unit requirements for producing market milk in Vermont, J. B. Bain, R. J. Posson, and R. P. Hotis (*U. S. Dept. Agr. Bul. 923* (*1921*), *pp. 18, figs. 2*).—This is a report on the cost of producing milk in Addison County, Vt., in 1917 and 1918 and is based on field studies conducted according to the plan followed elsewhere in previous investigations of this series (E. S. R., 44, p. 473). Records were obtained from 17 herds averaging 26.1 cows per herd during the first year and 18 herds averaging 22.4 cows the second year. Cows of Holstein reedihg predominated, and the annual milk production averaged 5,252 lbs. 'he milk was hauled to central receiving stations for shipment to New York s market milk. The following table summarizes the average feed and labor requirements for the two years:

Miscellaneous expenditures and amounts of feed and labor required for milk production in Addison County, Vt.

Basis of computation and season.	Mill feed.	Home-grown grain.	Legume hay.	Other hay.	Stover and fodder.	Silage, etc.	Human labor.	Horse labor.	Bedding.	Pasture.	Miscellaneous costs.[1]
Per cow:	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Hrs.*	*Hrs.*	*Lbs.*	*Acres.*	
November to April.	696	83	330	2,700	27	4,502	64.2	13.7	263	......	$11.18
May to October	235	16	79	403	61	805	58.8	10.4	....	3.0	10.58
Entire year	931	99	409	3,103	88	5,307	123.0	24.1	263	3.0	21.76
Per 100 pounds milk:											
November to April.	29.6	3.5	14.0	114.7	1.2	191.3	2.7	.6	11.2	......	.476
May to October	8.1	.6	2.7	13.9	2.1	27.8	2.0	.4	....	.1	.365

[1] Excluding changes in the inventory values of cows.

There were 4.5 tons of manure per cow saved in the winter and 0.8 ton saved in the summer. Fifteen per cent of the cows did not calve within the year, 27 per cent freshened between May 1 and October 31, and 58 per cent freshened during the rest of the year, usually well along in the spring.

Feed and bedding totaled 49.4 per cent of the gross costs (including depreciation), pasture 5.5 per cent, labor 21 per cent, and other costs 20.7 per cent. Depreciation of stock formed 3.4 per cent of the gross costs. Credits for manure equaled 17.7 per cent of the gross cost and credit for calves 5.5 per cent.

During the winter 41.7 per cent of the labor was performed by the managers, 47 per cent by hired men, 11.3 per cent by women and children. In the summer the corresponding percentages are 39.1, 42.4, and 18.5. In the winter 79.9 per cent of the labor was used for production as distinct from handling and hauling and in the summer 77.6 per cent.

To keep a bull for a year required 336 lbs. of concentrates, 6,734 lbs. of dry roughage, 2,396 lbs. of succulent roughage, 269 lbs. of bedding, and 37.7 hours of human labor, besides pasture costs and miscellaneous charges.

Pasturing experiments with dairy cows [at the Huntley, Mont., Reclamation Project Experiment Farm], D. Hansen and J. B. Shepherd (*U. S. Dept. Agr., Dept. Circ. 147 (1921), pp. 24–27*).—A report is presented of the second year (1919) of a comparative test of three different irrigated mixed-grass pastures for dairy cows (E. S. R., 43, p. 468). The most complex mixture (No. 1) consisted of awnless brome grass, orchard grass, tall fescue, perennial rye grass, Kentucky blue grass, white clover, and alsike clover. The others are modifications of this. The following table summarizes the results for the season:

Comparison of grass mixtures as pasture for milch cows, 1919. (Acre basis.)

Grass mixture number.	Character of pasture.	Daily number of cows.	Cow days on pasture.	Alfalfa hay fed.	Cow days in milk	Whole milk produced.	Butter fat produced.	Skim milk produced.	Net income.
				Pounds		*Pounds.*	*Pounds.*	*Pounds.*	
1	Complex (7 grasses)	1.535	216.5	536	227.5	4,528	168	3,967	$105.05
2	White and alsike clovers omitted	1.535	216.5	513	213.5	3,790	138	3,331	85.67
3	Brome grass and rye grass omitted	1.543	217.5	512	211.5	3,990	129	3,570	81.76

A cow day in this table means a 24-hour period, whereas in the table of 1918 this term was used to mean day as distinct from night. The net income represents the sum of the market values of the fat and skim milk less the value of the alfalfa hay fed, at $20 a ton. No hay was cut this season.

On one of the acre plats seeded to mixture No. 1 in 1916, a special study was made of the maximum carrying capacity. The acre afforded 255 cow days of pasture and carried on an average 1.808 cows daily. During 275 milking days there were produced 199 lbs. of butter fat and 5,329 lbs. of skim milk. The net income was $119.36 per acre.

[Feeding experiments with dairy cattle] (*California Sta. Rpt. 1920, pp. 71, 72*).—In experiments with milch cows, F. W. Woll and C. V. Castle found that increasing the amount of coconut oil meal fed beyond 2 lbs. per head per day caused a decrease in the butter-fat and milk production.

In a study of the comparative value of the hays from the different cereal plants for growing heifers, Woll found that the animals gained in weight on hay from most of the varieties of wheat, maintained their body weight on barley

hay and rye hay, and lost in weight on most of the oat hays. In a second trial wheat hay produced 14 per cent more gain than oat hay.

Raising calves on milk substitutes, [P.] DECHAMBRE (*Compt. Rend. Acad. Agr. France, 7 (1921), No. 6, pp. 107–122*).—This is a general review of personal observations and the published results by other investigators of the use of skim milk, whey, hay infusions, linseed meal, ground oats, and other cereal meals, bean broth, etc., for calf feeding. It is stated that fresh whey from Gruyère and Port-du-Salut cheese is very satisfactory, but that whey from Brie and Camembert cheese is too acid. Considerable emphasis is placed upon the necessity of having all of the three vitamins present in substitute feeds. Discussions by other speakers follow the main paper.

The influence of fresh food in lactation, E. B. FORBES (*Science, n. ser., 52 (1920), No. 1350, pp. 467, 468*).—The author has made palatability tests of mineral supplements with Holstein cows belonging to a group at the Ohio Experiment Station which, under the direction of C. C. Hayden, have received only dry feeds and silage since 1911. These cows, some of which have never eaten any green feed, have grown to full maturity and have reproduced without obvious abnormality, but their appetites are poor, they are easily thrown off feed, and their milk production is distinctly below what would be expected under normal feeding. The palatability tests, some details of which have been noted (E. S. R., 44, p. 175), showed that the cows have a keen desire for mineral feeds, particularly calcium preparations. These results are thought to favor the view of Hart, Steenbock, and Hoppert (E. S. R., 44, p. 64) that fresh grass contains a vitamin which promotes calcium metabolism.

Effect of dipping on the production of milch cows, F. TORRANCE (*Agr. Gaz. Canada, 8 (1921), No. 1, p. 25*).—Average milk records of 87 cows two days before and two days after dipping with lime and sulphur solutions for mange eradication are presented. There were no appreciable differences between the average production before and after dipping.

Foundation families of the [Holstein] breed, W. A. PRESCOTT (*Holstein-Friesian World, 18 (1921), No. 13, pp. 1338–1355, 1414, figs. 45*).—The author reviews the early importations of Holstein-Friesian cattle into this country, with particular reference to the cows now looked upon as the founders of important families. Many old illustrations are reproduced.

Goat keeping for milk production, C. J. DAVIES (*London: Off. "Country Life"; New York: Charles Scribner's Sons, 1920, pp. 219, pls. 12, figs. 8*).—This volume is written with particular reference to conditions in Great Britain, and discusses the origin and varieties of goats, housing and management, milk production, feeding, heredity and breeding, raising of young goats, the determination of the age of goats, the manufacture of dairy products from goat's milk, and diseases of goats. The author states that he has endeavored to give most space to topics not dealt with extensively in other readily available books.

Experimental researches on colostrum, C. PORCHER and L. PANISSET (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 3, pp. 181–183*).—In support and amplification of Porcher's theory (E. S. R., 43, p. 876) that colostrum is simply milk retained in the udder for an extended period during which the more soluble constituents tend to be resorbed and the colloids are altered by phagocytic action, the authors report the artificial production of a colostrum-like product by injecting sterile milk into the peritoneum of guinea pigs. The lactose was rapidly diffused, but the fat and protein became lodged in the peritoneal depots and were attacked by a wide variety of leucocytes which, according to the authors, resembled the types occurring in colostrum.

Some characters which differentiate the lactic acid streptococcus from streptococci of the pyogenes type occurring in milk, J. M. SHERMAN and

W. R. Albus (*Pennsylvania Sta. Rpt. 1917, pp. 360–372, pls. 4*).—Previously noted from another source (E. S. R., 42, p. 773).

To determine pasteurization, M. Grimes (*N. Y. Prod. Rev. and Amer. Creamery, 50 (1920), No. 14, pp. 814–817*).—The author reports an investigation of the Storch test for heated milk at the Ontario Agricultural College. After a study of different concentrations of the reagents, it was concluded that a 0.5 per cent solution of the hydrogen peroxid and a 0.2 per cent solution (freshly mixed) of the paraphenylenediamin gave the sharpest reaction when 1 cc. of each was used with 10 cc. of the milk to be tested.

Fresh milk heated above 172° F. gave a decided negative reaction, and it was found that admixture of less than 4 per cent of raw milk with the heated milk did not affect the test. Cream heated to 150° in 32 minutes and held at that temperature for 20 minutes remained positive throughout. Cream samples heated to 150° more rapidly (25 minutes or less) with the temperature allowed to go higher (about 160°) before cooling gave negative reactions. Cream heated to 160° in 15 minutes reacted negatively without further holding. Butter made from cream samples that reacted negatively also gave negative tests.

The potassium iodid-starch test was found not to give consistent results for temperatures between 160 and 180°.

Storch pasteurization test, M. Grimes (*N. Y. Prod. Rev. and Amer. Creamery, 51 (1921), No. 13, p. 592*).—Continuing the work noted above, the author reports that a high degree of acidity (about 0.42 per cent lactic acid) in milk or butter causes raw milk and butter made from raw cream to give a negative reaction to the Storch test. A modification of the test is therefore proposed, in which the sample is neutralized by sodium hydroxid before the hydrogen peroxid is added.

Bitterness in evaporated milk, G. Spitzer and W. F. Epple (*Jour. Dairy Sci., 3 (1920), No. 6, pp. 486–492, pl. 1*).—An organism identified on morphological and cultural grounds as *Bacillus panis* Migula was isolated from samples of bitter evaporated milk sent to the Indiana Experiment Station by the manufacturer. Bitterness was induced in ordinary sweet milk by experimental inoculations and was found not to be associated with increased acidity. From a chemical study of the decomposition products, it is concluded that the organism secretes at least one and perhaps several specific proteolytic enzyms producing both peptones and amino acids. The marked peptonizing action is deemed the primary cause of the bitter taste.

The spores were killed by from 8 to 10 minutes' exposure to 250° F. under 15 lbs. pressure.

Dairy products (*California Sta. Rpt. 1920, pp. 72–74*).—In an experiment conducted by S. L. Denning a lot of butter was pickled in brines of different concentrations on June 13 and kept at room temperature. On July 22 it was found that the 30 per cent salt solution had preserved the butter in the best condition. The sample preserved in saturated brine (40 per cent salt) was ranked second, and the sample preserved in 20 per cent salt solution was inferior to the sample left in the carton outside the brine. By October 14 none of the samples were in good condition except the portions that had been kept in a refrigerator.

Observations of C. L. Roadhouse and J. C. Marquardt on the keeping quality of milk in two types of water coolers are cited. The burlap cooler was found to be as efficient as the cement cooler, and in both types bottled pasteurized milk remained sweet for periods of at least 24 hours throughout the summer months

In a study of starters for pasteurized milk in making Cheddar cheese, H. S. Baird found that no cultures gave satisfactory results with milk pasteurized at 168° F. by the continuous process. More favorable results with certain of the cultures were secured when the milk was held at 145° for 20 minutes and then cooled to the setting temperature of 86°. The cultures were developed in raw milk.

An original package of whole milk powder manufactured December 8 was examined at weekly intervals by Marquardt, and an "old" flavor was noticed first on February 2. A rancid odor in the aqueous solution of the powder was noticed on March 28.

Analyses of goat's milk are summarized.

Management of dairy plants, M. MORTENSEN (*New York: Macmillan Co., 1921, pp. XVI+358, figs. 36*).—This volume treats mostly of the business side of creameries and other dairy plants. The topics discussed include form of organization, creamery construction, sewage disposal, refrigeration, the management and payment of labor, purchase of milk and cream, purchase of equipment and supplies, the cost of motive power, the cost and efficiency of pasteurization, the cost of water, the nature of rent, depreciation, interest, and insurance, the butter overrun, mechanical losses of butter fat, cost of manufacturing butter, profits obtained from the manufacture of ice cream, marketing and the cost of marketing dairy products, advertising dairy products, business correspondence, credits and collections, and creamery bookkeeping. Forty-three different record forms are included.

VETERINARY MEDICINE.

Division of veterinary medicine, C. P. FITCH (*Minnesota Sta. Rpt. 1920, pp. 56–61*).—In the report of work with contagious abortion of mares, it is stated that *Bacillus abortivo equinus* does not occur in the station breeding stock. The use of antistreptococcic serum was continued with gratifying results, not a single fatal case of arthritis in foals having occurred since its use was commenced. The pathology of sterility in bovine infectious abortion and investigations of infectious white scours and calf pneumonia are briefly considered.

Brief reference is made to investigations of the gross and microscopical lesions of hog cholera, lesions characteristic of hog cholera in immune carcasses, and longevity of hog-cholera virus. The results indicate that hog-cholera virus remains virulent as long as three years if phenolized and kept at a low temperature.

The tuberculin test research work has continued to cover especially the relative accuracy of the intradermal, ophthalmic, and thermal tests and the relative desirability of several possible combinations of these tests.

Report of veterinarian, C. A. CARY (*Alabama Col. Sta. Rpt. 1920, p. 32*).—In experiments in which the fruit, leaves, twigs, and roots of red buckeye (*Æsculus pavia*) were fed to pigs, cattle, and mules to determine their toxic action, in only one instance was any toxic effect apparent. In a 700-lb. mule to which 1 gal. of liquid, obtained by macerating 4 lbs. of buckeye roots, was administered by means of a stomach tube some symptoms of intoxication appeared, but all such symptoms had disappeared within 24 hours.

Studies of the effect of an exclusive ration of velvet beans upon brood sows are under way.

The course of migration of Ascaris larvæ from the intestine to the lungs, B. H. RANSOM and E. B. CRAM (*Abs. in Anat. Rec., 20 (1921), No. 2, p. 207*).—"In some recent experiments in which guinea pigs have been killed and examined during the first few days after feeding with eggs of *A. suum*, the present writers have repeatedly recovered Ascaris larvæ from the portal vein

and vena cava but have rarely found them in the abdominal or pleural cavities. Accordingly, the larvæ appear to be not uncommonly carried in the circulation, and it would seem that further evidence is necessary before Yoshida's conclusions [E. S. R., 41, p. 286] as to the direct migrations of the larvæ through the tissues can be accepted as final."

Sour milk substitutes for controlling coccidiosis (*California Sta. Rpt. 1920, p. 80*).—Investigations by J. R. Beach indicate that several of the commercial sour-milk substitutes can be used in place of sour milk in the control of coccidiosis.

Serum vaccination for foot-and-mouth disease in the district of North Ditmarsh, H. Warringsholz (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 42, pp. 489–492*).—Statistics are given of the results of vaccinating cattle and hogs against foot-and-mouth disease with immune serum and with serum or blood from animals suffering from the disease. Of a total of 907 animals, 445 received the immune serum, and 439 the serum and 23 the blood from diseased animals. Of these 29 succumbed following vaccination, including from the first group 2 cows and 10 shotes apparently well at the time of vaccination, and 2 cows, 4 calves, and 2 shotes, all of which were very sick at the time of vaccination. The deaths from the second group included 1 calf and 1 shote from the healthy animals and 2 cows, 1 calf, and 4 shotes from the diseased animals. All of the 23 animals vaccinated with whole blood survived.

While the results were considered satisfactory with all three methods, the second method, involving the use of serum from the blood of diseased animals, is preferred. The vaccination of healthy animals is considered of value in heightening the resistance against natural or artificial infection and in conferring at times a brief immunity, and of sick animals in mitigating the severity of the disease and lowering the mortality.

Results of serological tests for glanders in the field.—The value of different methods, Poppe (*Berlin. Tierärztl. Wchnschr., 35 (1919), No. 21, pp. 173–175, fig. 1*).—From statistical data obtained in blood tests and subsequent findings on autopsy of over 2,000 horses condemned as glandered in the course of a field experience of over three years, the author rates the relative value of the different blood tests for the diagnosis of glanders as follows:

The complement deviation method is considered of the greatest value, followed in turn by the K. H. reaction and the conglutination and agglutination tests. The last mentioned, while of considerable value in the detection of acute glanders, is thought to be of less value in the detection of chronic cases than the K. H. or conglutination tests. The precipitation test is deemed of little value. As it is impracticable to use all four tests in the field, the author recommends the conglutination and K. H. reactions, at least in cases where the deviation and agglutination reactions are positive or doubtful. Data are also included on a few mallein tests, indicating that this test is of less value than the serological methods.

Transmission of intermittent fever, or infectious anemia, of horses to swine, Lührs (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 11, pp. 121–123*).—The author concludes that swine are somewhat susceptible to infectious anemia of horses, but that it is mostly a latent and chronic affection. The virus can be demonstrated in swine 143 days after infection. Passage through swine does not increase its virulence for the horse or for swine.

The efficacy of chemical disinfectants for tetanus spores, T. Moll (*Centbl. Bakt. [etc.], 1. Abt., Orig., 84 (1920), No. 6, pp. 416–434*).—In testing the efficacy of various chemicals in destroying tetanus spores the author used the garnet method slightly modified according to unpublished directions of Eicholz. Bohemian garnets of uniform size, carefully cleaned by treatment with hot HCl

and washing with water and sterilized by heating at 180° C. for 30 minutes, were shaken in an aqueous suspension of the test bacteria and dried. A definite number of these garnets were then added to a solution of the disinfectant of a given strength, shaken thoroughly to dislodge the organisms, and the suspension mixed with agar at 45° and plated in petri dishes.

The comparative results obtained with different disinfectants under carefully controlled conditions show that oxidizing materials, such as the halogens and hydrogen peroxid, have the strongest bactericidal effect on tetanus spores, while protein-precipitating substances, such as alcohols, heavy metals, phenols, and cresols, have only slight, if any, action. Of the oxidizing materials iodin trichlorid had the strongest bactericidal action. A table is given of the substances tested and the time required for complete disinfection.

Factors in the resistance of guinea pigs to tuberculosis, with special regard to inbreeding and heredity, S. WRIGHT and P. A. LEWIS (*Amer. Nat., 55 (1921), No. 636, pp. 20–50, figs. 7*).

[Tuberculosis investigations] (*California Sta. Rpt. 1920, pp. 76, 77*).—A brief report is given of an investigation by J. Traum, suggested by the studies of Walker and Sweeney (E. S. R., 42, p. 777), of the results of the treatment of tuberculous cattle with sodium chaulmoograte. Of 15 calves reacting strongly to the intradermal tuberculin test after having been rendered tuberculous by drinking water containing tuberculous lung material from cattle, 5 received intravenously 203 cc. of a 3 per cent solution of sodium chaulmoograte between September 11, 1919, and January 26, 1920. Five other calves received 590 cc. each, and the 5 remaining animals used as controls were not treated. At autopsy on March 22, 1920, no appreciable difference was found between the lesions of the treated and untreated animals, thus indicating that sodium chaulmoograte has no definite therapeutic value in the treatment of bovine tuberculosis.

The report also includes a general discussion of the value of the intradermal and combined tuberculin tests and of the advantages and safety in the segregation of tuberculous herds to serve as sources of supply of healthy animals and to furnish milk which can be rendered safe by proper pasteurization.

New experimental researches on the vaccination of cattle against tuberculosis, A. CALMETTE and C. GUÉRIN (*Ann. Inst. Pasteur, 34 (1920), No. 9, pp. 553–560, fig. 1*).—From a series of control experiments, arranged to test the duration of the immunity produced in cattle by inoculation with attenuated cultures of bovine tubercle bacilli by the method previously described (E. S. R., 30, p. 482), the authors conclude that the immunity established by the first vaccination does not continue longer than 18 months. It can, however, be extended indefinitely by yearly vaccinations which are in themselves harmless.

New experiments on the vaccination of cattle against tuberculosis, A. CALMETTE and C. GUÉRIN (*Vet. Rec., 33 (1921), No. 1699, pp. 93–95, fig. 1*).—This is an English translation of the article noted above.

Progress of cooperative tuberculosis eradication work, J. A. KIERNAN (*Vet. Med., 16 (1921), No. 2, pp. 25–29*).

Simple goiter in calves, W. T. JOHNSON (*Washington Sta., West Wash. Sta. Mo. Bul., 8 (1921), No. 11, pp. 178–180, fig. 1*).—This is a brief popular account of a condition often met with in certain parts of western Washington. Investigations of this disease at the Washington Experiment Station, by Kalkus, have been noted (E. S. R., 44, p. 479).

Blackleg in sheep, WITT and W. STICKDORN (*Berlin. Tierärztl. Wchnschr., 35 (1919), No. 24, pp. 199–201*).—This is a brief discussion of the occurrence, symptoms, and differential diagnosis of blackleg in sheep and methods of im-

munization. Successful results are reported of immunization experiments involving the use of metabolism products of blackleg bacilli and washed spores according to the method of Foth (E. S. R., 28, p. 376). A list of 15 literature references is appended.

On the nomenclature of hog cholera and swine plague, F. V. Hutyra (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 17, pp. 185–188*).—The author considers the nomenclature of hog cholera and related diseases at some length. The groups and synonyms are summarized as follows: (1) Hemorrhagic septicemia (Schweineseuche of Löffler and Schütz, classical Schweineseuche, swine septicemia, swine plague). Cause: *Bacillus suisepticus.* (2) Hog cholera (Schweinepest, virus pest, and pest of Schern and Stange. Virus pest and mixed infection of Joest, swine fever). Cause: Filterable virus; secondary, bacilli of coli-typhoid group and *B. suisepticus.* (3) Broncho-pneumonia of pigs (enzootic catarrhal pneumonia of pigs, chronic Schweineseuche, pig cough, etc.). Cause: Faulty hygienic and dietetic conditions; secondary, different facultative pathogenic bacteria. (4) Paratyphoid of swine (bacillary hog cholera of Dammann and Stedfeder and Joest, Ferkel typhus of Glässer and Pfeiler, caseous enteritis). Cause: Coli-typhoid-paratyphoid group.

Hog cholera in Arizona, R. H. Williams (*Ariz. Agr. Col. Ext. Circ. 32 (1920), pp. [14], figs. 4*).—This is a popular summary of information, with directions for protective treatment.

Hog cholera and immature corn, J. W. Connaway (*Missouri Sta. Bul. 174 (1920), pp. 20, figs. 9*).—This popular account of hog cholera is prepared with the view to impressing upon the minds of swine feeders the fact that losses from disease in the feed lot are due primarily to hog cholera, and that the popular notion that immature corn may originate this disease is a fallacy.

The serum diagnosis of dourine in horses by means of the complement deviation method and K. H. reaction (hemagglutination), F. Angleitner and S. Daněk (*Berlin. Tierärztl. Wchnschr., 32 (1916), No. 46, pp. 541–544*).—The complement deviation and K. H. reactions have both been found of value in the diagnosis of dourine, and the latter is recommended in the case of donkeys, mules, and hinnies. As antigen the authors recommend an emulsion of washed dourine trypanosomes or a heated extract of the blood of rats inoculated with dourine trypanosomes and killed at the height of infection.

Horse sickness in the Belgian Congo, R. Van Saceghem (*Bul. Agr. Congo Belge, 10 (1919), No. 1–4, pp. 162–174, figs. 6*).—The author concludes that the virus of heartwater of sheep will cause horse sickness, and that the virus of horse sickness will produce a febrile reaction in sheep and goats. The causative organism of horse sickness and that of heartwater are considered different forms of a single virus.

Vaccination against strangles, R. Van Saceghem (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 15, pp. 645–647*).—The strangles vaccine employed by the author at the remount station of the Belgian Army consists of a 2-day bouillon culture of the streptococcus isolated from the pus of infected horses. The culture is heated to 56° C. for 30 minutes before use and is administered in three subcutaneous injections at 8-day intervals, 5 cc. being used for the first and 10 cc. for the later doses. The first injection produces slight local and thermal reactions which are more pronounced in young than in old animals. The vaccine is also used therapeutically in repeated subcutaneous injections of 10 cc. in severe cases of the disease.

A provisional key to the adult nematode parasites of equines, W. A. Riley (*Cornell Vet., 11 (1921), No. 1, pp. 21–41, figs. 43*).—This gives an illustrated key to the adult nematode parasites found in equines.

Chicken pox (epithelioma contagiosum) (*California Sta. Rpt. 1920, pp. 78, 79*).—Continuing the studies of immunization against chicken pox (E. S. R., 42, p. 886), further experiments were conducted by J. R. Beach in an effort to develop and standardize a vaccine or method of administration that will protect against severe artificial infection in a larger percentage of cases.

Intracutaneous injections in the wattle of cockerels of 0.1 to 0.05 cc. of ordinary vaccine afforded protection against artificial infection for 30 days in 86 per cent of the fowls treated, while similar injections of 0.1 cc. of a vaccine prepared by shaking desiccated chicken pox scabs in sterile salt solution in 1, 5, and 10 per cent concentrations afforded protection for the same length of time in all cases. Both vaccines, however, when thus administered produced areas of induration at the point of injection in 90 per cent, and small chicken pox lesions at the point of injection and elsewhere about the head in nearly 40 per cent of the birds vaccinated. Subcutaneous injections of 1 cc. doses of the 5 and 10 per cent "shake extract" protected against artificial infection for 30 days.

Vaccine from the second and third growths of scabs was found to be as potent as that prepared from the first growth, indicating that the variation in immunizing value of different lots of vaccine is due to variation in the virus produced by different lots of fowls rather than variation in the virulence of first and subsequent growths of scabs on the same fowls.

It has been found impossible to determine the degree of immunity to be expected from a given vaccine from observations of the lesions produced by scarification of the comb.

In the choice of Leghorn cockerels for the production of chicken pox virus, the use of mature birds rather than those of broiler size is recommended as more economical on account of the greater production of scabs.

Fowl cholera (*California Sta. Rpt. 1920, p. 80*).—Two experiments undertaken to determine the value of bacterins for controlling fowl cholera are briefly noted. In one flock of 800 hens, half were vaccinated and left in the same quarters which had been thoroughly cleaned and disinfected, while the other half were not vaccinated but were moved to other quarters where no poultry had been kept for several months. In another, one-half the flock, numbering 164, were vaccinated twice but not separated from the others. In both experiments the deaths from fowl cholera were slightly more numerous in the vaccinated than in the nonvaccinated fowls.

Active immunization against fowl cholera, A. Szász (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 20 (1919), No. 1, pp. 26–62, figs. 4*).—The vaccine employed by the author with a large number of chickens, ducks, geese, and turkeys consisted of a 4 to 5-day bouillon culture of the most virulent strains of fowl cholera bacilli injected subcutaneously in single doses of from 3 to 5 cc. The reaction ensuing was often marked but seldom fatal, drowsiness and thirst lasting from 6 to 8 hours being the principal symptoms. In a total of 7,426 vaccinated birds in infected flocks there were 212 deaths, or a mortality of 2.85 per cent, while among the 854 nonvaccinated controls there were 291 deaths, or a mortality of 34.07 per cent.

A nutritional disease of poultry (*California Sta. Rpt. 1920, p. 79*).—A disease characterized by weakness, emaciation, formation of white film or masses of yellowish-white material in the eye, a discharge from the nostrils, and the appearance of yellowish-white pustule-like lesions in the mouth, pharynx, and esophagus was studied by C. M. Haring, J. R. Beach, and M. E. Jaffa. Bacteriological studies of the dead fowls revealed no organism to which the disease might be attributed, and attempts to transmit the disease by inoculation were negative. Observations made in several outbreaks led to the conclusion that

the disease is produced chiefly by a shortage of greens, although an excess of protein in the ration, the use of coconut meal in the mash, or rations deficient in protein may be important factors.

RURAL ENGINEERING.

The use of concrete pipe in irrigation, F. W. STANLEY and S. FORTIER (*U. S. Dept. Agr. Bul. 906* (*1921*), *pp. 54, figs. 36*).—Information concerning pipe and pipe systems, and more especially the use of concrete pipe in irrigation, is presented in this bulletin, together with such practical suggestions regarding making and laying as may enable those engaged in the work to avoid mistakes and attain satisfactory results. The information presented appears to be based largely on the experience of different water and irrigation companies, principally in California. The different phases of the subject discussed are plain and reinforced concrete pipe, manufacture and cost of plain concrete pipe, pipe systems for irrigation, settling basins, screens, air vents, relief stands, measuring devices for pipe irrigation systems, and distributing hydrants.

An investigation of perforated-pipe filter underdrains, H. N. JENKS (*Engin. News-Rec.*, *86* (*1921*), *No. 4*, *pp. 162–166, figs. 5*).—Experiments with straight new lengths of standard black wrought-iron pipe, each with an effective length of 12 ft. and a distance between first and last perforations of 11 ft. 6 in., are reported.

The studies embraced a determination of (1) the conditions resulting in the optimum hydraulic characteristics in relation to total head required and uniformity of discharge along the lateral and (2) the conditions governing the uniformity of diffusion of the wash water up to the top of an 18-in. bed of graded gravel, the variable factors being the size and spacing of laterals and of the perforations therein and the rate of wash.

The results indicated that for this type of rapid sand filter underdrain, the ratio of the length of a lateral to its diameter governs the uniformity of discharge. This ratio should not exceed 60. The diameter of perforations should be between $\frac{1}{4}$ and $\frac{1}{2}$ in., and the spacing of perforations should vary from 3 in. for $\frac{1}{4}$-in. perforations to 8 in. for $\frac{1}{2}$-in. perforations. The ratio of the total hole area of the lateral to its cross sectional area should not exceed 0.5 for $\frac{1}{2}$-in. perforations and should decrease to 0.25 for $\frac{1}{4}$-in. perforations. The ratio of the total hole area of the lateral to the filter area may be as low as 0.002 or 0.3 sq. in. per square foot of filter. The spacing of laterals may be as great as 12 in. for satisfactory diffusion, but is limited by the total head available. A gravel bed depth of 18 in. composed of graded sizes insures excellent diffusion of wash water. The rate of discharge may be varied from 6 to 36-in. vertical rise per minute with satisfactory results in regard to distribution of wash, provided the above factors are employed in the design.

Effect of worn runners on dredge pump efficiency, I. E. HOUK (*Engin. News-Rec.*, *86* (*1921*), *No. 4*, *pp. 169, 170, fig. 1*).—Tests of 15-in. dredge pumps with 37 and 39-in. 4-vane cast-iron runners showed that the average efficiency of the pump with the 39-in. runner was reduced from about 57 per cent when the runner was new to about 45 per cent when it was worn out. The average efficiency of the pump with the 37-in. runner was reduced from about 50 to about 44 per cent. These results are taken to indicate the economic necessity of providing for prompt replacement of worn runners.

Water supply of St. Mary and Milk Rivers, 1898–1917, B. E. JONES and R. J. BURLEY (*U. S. Geol. Survey, Water-Supply Paper 491* (*1920*), *pp. 590, pls. 26*).—This report contains records of flow of streams and canals in the St. Mary and Milk River Basins, collected by the U. S. Geological Survey in cooper-

ation with the U. S. Reclamation Service and by the Reclamation Service of Canada, in accordance with an authorization of the International Joint Commission.

A simple method of water supply, P. A. A. F. Eijken (*Geneesk. Tijdschr. Nederl. Indie, 58 (1918), No. 1, pp. 140–143*).—Experiments are described in which it was found that where the ground water is of suitable chemical composition, a supply of potable water may be obtained by the use of gravel pits. These are constructed by throwing coarse gravel into existing shallow wells, followed by successive layers of gravel of decreasing size, with a final layer of fine sand. It is stated that the water pumped from such wells is equal in quality to that purified by more elaborate processes. Analyses of samples are included.

Concrete work, W. K. Hatt and W. C. Voss (*New York: John Wiley & Sons, Inc., 1921, pp. XIX+451, pls. 23, figs. 267*).—This volume is the first of a technical series edited by W. H. Timbie. Its purpose is "to extend the scope of work now possible to the concrete worker of unguided experience by bringing him to an intelligent understanding of the scientific principles underlying his art, and by introducing him to the wider opportunities that exist for him in modern concrete construction."

Chapters are included on plans, details, and specifications; simple footings; column footings; concrete walls; reinforced concrete frame; erection of reinforced concrete; pre-cast stone; walls and partitions; concrete walks and pavings, and concrete roads and pavements; building finish, and recommended practice for Portland cement stucco; special concrete constructions; and estimating.

The construction of roads and pavements, T. R. Agg (*New York: McGraw-Hill Book Co., Inc., 1920, 2. ed., rev. and enl., pp. X+463, pl. 1, figs. 115*).—This is the second revised and enlarged edition of this book (E. S. R., 36, p. 285), in which material on the progress in highway engineering, especially with regard to the construction of rural highways, has been added. New material has also been included on assessments for pavements, drainage and the control of erosion, maintenance, and proportioning aggregates for concrete roads. The chapter on testing highway materials has been rewritten.

Some considerations governing the design of pavements for heavy traffic, P. Hubbard (*Good Roads, n. ser., 21 (1921), No. 2, pp. 11–14, figs. 2*).—Data on the design of pavements for heavy traffic are summarized.

It is emphasized that careful attention to subgrade and drainage is the first essential to be considered. The asphaltic concrete pavement is highly resistant to impact and develops as a single unit relatively high slab and beam strength. It is considered uneconomical to adopt a design which will permanently bridge appreciable areas of weak subgrade. Test and service data are summarized to show that it is not necessary to adopt as massive a design for the flexible type of base under given conditions as for the rigid type.

Effects of motor operation costs on highway location and grade design summarized, W. G. Harger (*Engin. News-Rec., 86 (1921), No. 5, pp. 201–203, figs. 3*).—This article supplements one previously noted (E. S. R., 44, p. 86), the purpose being to give simple rules and methods for the practical application of the general principles there laid down.

Report of the State Road Commission of West Virginia for the period July 1, 1919, to July 1, 1920, J. K. Monroe and C. P. Fortney (*W. Va. State Road Comn. Rpt., 1920, pp. 200, figs. 58*).—This report covers the activities and expenditures of the West Virginia State Road Commission for the year ended June 30, 1920.

Public Roads (*U. S. Dept. Agr., Public Roads, 3 (1920), No. 32, pp. 32, figs. 6*).—This number of this periodical contains the following articles: Papers and Discussions at the Highway Officials' Convention; The Address of the Secretary of Agriculture, by E. T. Meredith; The President's Address, by P. D. Sargent; Federal-Aid Accomplishments, by T. H. MacDonald; The Traffic Census, by A. N. Johnson; and Federal-aid Allowances—Project Statements Approved and Project Agreements Executed in November, 1920.

The bull and the treadmill, O. TRETSVEN and H. E. MURDOCK (*Montana Sta. Circ. 93 (1920), pp. 7, figs. 5*).—Three years' experience at the station farm in working a dairy bull for exercise on a treadmill and the results of recent experiments to determine the mechanical horsepower thus generated are reported.

It was found that a 2-year-old Holstein bull was able to operate a feed cutter, root slicer, and the vacuum pump of a mechanical milker. It was necessary to use a gasoline engine to relieve the bull toward the end of each working period until he became accustomed to the task. To prevent him from stopping an automatic slapper was used, which was set across the rack behind the bull and so arranged that when he stopped walking his thighs brought pressure upon the mechanism, which recoiled and released a spring, thus giving him a hard slap. The slapper automatically cocks itself for further punishment.

The time required to oil, start, operate, and stop the treadmill was found to be no greater than that for a gasoline engine when the time required to keep the engine in condition was considered. The daily exercise in a treadmill kept the bull tractable and in good physical condition.

It is concluded that the power is well suited for operating cream separators, water pumps, mechanical milkers of a size within the capacity of the bull, and other light-running machines on the farm. Treadmills with flat treads were found to be preferable, as they prevent slipping.

To determine the power developed by bulls in a treadmill, a series of experiments was conducted with a Holstein bull weighing 2,060 lbs. and a Jersey bull weighing 1,250 lbs. The angle of the tread was varied to cover all those most likely to be used in practice as well as the various speeds of the bull. A Prony brake was used and the results are graphically reported.

It was found that the force on the brake was about constant for a given angle for each bull. A speed of 60 revolutions per minute, which represented a walking speed of the bull of 1 mile per hour, seemed to be about the best. The average horsepower developed by the 2,060-lb. bull at that speed varied from 0.75 to 1.02 for the slopes varying from 20 to 25.1 per cent, and that developed by the 1,250-lb. bull varied from 0.42 to 0.62. The mechanical efficiency also increased slightly as the slope was increased and was a little higher for the heavier animal.

The present status of the isolated gas-electric generating plant, C. FROESCH (*Jour. Soc. Automotive Engin., 8 (1921), No. 1, pp. 28–37, figs. 14*).—Considerable data are given on the important features of isolated gas-electric generating plants at present available for farm use, and the characteristics of an ideal plant for a farm of from 100 to 140 acres are discussed.

Researches on alcohol as an engine fuel, H. B. DIXON (*Abs. in Jour. Soc. Automotive Engin., 7 (1920), No. 6, pp. 521–524*).—This is an abstract of a paper submitted to the fuels section of the Imperial Motor Transport Conference in London, October 18, 1920. The object of the studies was to compare alcohol with gasoline and other hydrocarbons as a fuel for motor vehicle and other small engines, and to determine how much the properties of alcohol are modified by admixture with other volatile fuels.

The conclusions are drawn that alcohol possesses most of the properties required in an engine fuel. As compared with gasoline, its lower calorific value

is almost compensated for by the greater compression at which it can be used, and this property, of high ignition temperature under compression, is hardly altered by admixture with 20 per cent of benzine or of gasoline itself. Such a mixture readily starts in the cold and has been shown to run very smoothly and without knocking in an engine.

The combustion of fuels in the internal-combustion engine, T. Midgley, Jr. (*Jour. Soc. Automotive Engin., 7 (1920), No. 6, pp. 489–497, figs. 18*).—The author deals briefly with the organic chemistry of internal-combustion engine fuels and reviews the results of considerable research into the combustion of fuels in internal-combustion engines, with particular reference to the phenomenon of knock. The opinion is expressed that knock is due to detonation of the gas charge in a cylinder.

Fuel studies to determine the order of their tendency to knock showed that the ethers are the worst knockers, followed by the paraffins, which include the fuels in common use. These are followed in order by the olefins, the naphthenes, aromatics, and alcohols.

The theory of knock suppressors is also discussed.

Piston rings, L. G. Nilson (*Jour. Soc. Automotive Engin., 7 (1920), No. 6, pp. 525–531, figs. 22*).—The evolution of piston rings for internal-combustion engines is discussed, and information is given on materials, design, and fitting.

Automotive ignition systems, E. L. Consoliver and G. I. Mitchell (*New York: McGraw-Hill Book Co., Inc., 1920, pp. X+269, figs. 357*).—This book was prepared in the extension division of the University of Wisconsin and deals with the ignition systems used on tractors, trucks, automobiles, and airplanes.

The authors had in mind the needs of men who have to install, adjust, and repair ignition systems, and the book is therefore written essentially from the practical viewpoint. Its scope is indicated by chapters on the principles of electricity and magnetism, ignition batteries, the jump-spark ignition system, modern battery ignition systems, battery ignition systems for multiple cylinder engines, the low-tension magneto, modern high-tension magnetos—armature and inductor types, care and repair of ignition apparatus, and ignition troubles and remedies.

Agricultural engineering (*California Sta. Rpt. 1920, pp. 81, 82*).—Studies by J. B. Davidson and L. J. Fletcher on the effect of speed on draft of plows showed an average increase of about 33 per cent in draft between speeds of 1 and 4 miles per hour.

Studies by A. W. Hoffman on the reclamation of used gas engine crank case oil indicate that average used oil will settle out its carbon and other dirt in from three to eight weeks, according to the temperature and amount of fuel residues in the oil. The body of the oil can be restored completely by driving off the fuel residues by steam and agitation.

Why standardize tractor ratings? O. W. Sjogren (*Agr. Engin., 1 (1920), No. 4, pp. 67, 68, figs. 2*).—A comparison of the performances of 44 different models of tractors tested under similar conditions, to determine how nearly they conform to the standard recommendations of the American Society of Agricultural Engineers and the Society of Automotive Engineers as to ratings and belt speeds, are reported as conducted at the University of Nebraska.

Taking the maximum power results obtained for one hour as 100 per cent and the manufacturers' ratings as percentages thereof, it was found that only 7 of the machines fell within the standards as regards belt horsepower, while 35 carried ratings higher than that permitted by the standard. On a similar basis, but carrying the rated load for 10 hours, 32 of the machines fell within the standards for drawbar horsepower, while 8 were rated too high.

Considerable variation was also found to exist in piston displacements in cubic inches per horsepower minute. Of the 44 tractors the lowest displacement was 9,420 cu. in. and the highest 17,400, with an average for all of 12,845 cu. in.

The belt speeds also varied widely, ranging from 2,000 ft. to above 4,000 ft. per minute.

Pisé de terre construction (*Rev. Soc. Rural Córdoba [Argentina], 20 (1920), No. 370, pp. 5382–5413, figs. 8*).—General information on pisé de terre construction as practiced in Argentina and European countries is given.

Grain storage, J. F. HOFFMANN (*Die Getreidespeicher. Berlin: Paul Parey, 1916, pp. XVIII+829, figs. 732*).—This is a rather elaborate treatise on the subject of grain storages and elevators and their machinery and equipment, covering practice in Europe and North America in planning design, construction, and operation.

RURAL ECONOMICS AND SOCIOLOGY.

[Studies in agricultural economics], R. L. ADAMS (*California Sta. Rpt. 1920, pp. 80, 81*).—Four investigations are briefly reported here relating respectively to the relation of equipment investment to total capital; the size of farms, gross output, and investment; prewar and postwar costs of and receipts from crops; and the increase in costs of farm equipment.

Preliminary studies of 24 grain, dairy, and fruit farms, made by the author and L. R. Ward, indicate that in the grain-raising business 19 per cent of the total investment is in equipment, in the dairy business 58 per cent, and in the fruit business 24 per cent.

Details of 1919 data relating to average farm investment in the irrigation districts of Imperial, Modesto, and Turlock are tabulated.

Operating costs of producing 34 California field, fruit, and vegetable crops in 1919, compared with similar data of 1915, show a general increase in costs amounting to 66 per cent for all crops involved, the range being from 20 to 140 per cent. An average increase of 115 per cent in the usual price received by producers is noted, the range being from minus 10 per cent to 328 per cent. On the acreage basis, the average gross returns for these crops amounted to $230 per acre in 1919 as compared with $107 in 1915 Costs of production per acre in the same years averaged respectively $110 and $66.

An average increase of 52.3 per cent during the period between 1915 and 1919 for 111 cost items for implements, machinery, supplies, and materials is noted. The greatest increase was in building materials, 82.6 per cent. Implements, wagons, and farm machinery showed an increase of 51.1 per cent, and miscellaneous minor equipment and supplies 48.4 per cent.

Survey study of the progress and prosperity of northern Minnesota settlers, A. BOSS (*Minnesota Sta. Rpt. 1920, pp. 37, 38*).—A study is noted here which is being carried on in three areas in northern Minnesota, in Mahnomen, Beltrami, and Itasca Counties. Records were obtained from about 65 farms in each area. The average size of farm typical of the three counties was, respectively, 293 acres, of which 128 were in crops; 162 acres, with an average of 26.5 acres cleared; and 125 acres, with 36 acres cleared. The average net worth of the settlers at the time of settlement was $770 in Beltrami County and $658 in Itasca County. It is said that the high cost of clearing and the small initial capital compel the settler to find employment off the farm and delay the progress of settlement. The market for forest products is an important source of income.

Influence of capital on farm organization.—I, In a live-stock section, O. R. Johnson and R. M. Green (*Missouri Sta. Bul. 175 (1920), pp. 20, figs. 4*).—A study is being made to determine the importance of capital in live-stock farming on high-priced land and in grain farming on low-priced land. This discussion deals with the farm organization of 202 farms in Saline County, Mo., a corn and live-stock feeding section, for the farm year 1914–15. Effort was made to obtain the farmer's net income for the year and enough additional information to analyze his success or lack of it.

Crop yields in the area surveyed were above the average and land prices very high. The farms studied are divided into four capital groups, each of which is in turn subdivided into a class for the successful and one for the less successful operators, depending on the labor income In group one, the division point is a labor income of $600. In the other groups the class marked low labor income included farms which made less than $100 wages for the operator, while those marked high income made more than $100.

The conclusions are arrived at that men with less than $5,000 capital should not attempt to own land in the moderate to high-priced farming section, that all their capital should be used as working capital, and that it is important to rent an area large enough to employ men and horses efficiently. In the group of farms in which from $5,000 to $20,000 capital is invested the main differences in income were due to amounts invested per acre for the yields realized and efficiency in care and feeding of live stock. Problems confronting men with from $20,000 to $40,000 are said not to differ greatly from those in the above class, except that the renting of additional land is not important. On farms with more than $40,000 capital the low incomes were made generally by older operators not farming all their land but living on an interest return of from 3 to 4 per cent.

It is said that operators making money in any class used silage to cheapen their rations. Skill or luck in buying or selling was not a small factor in their success with cattle. In raising hogs, the more successful men raised two litters of pigs a year from their brood sows and held down loss from disease.

Returns obtained under 1914 price conditions are translated in terms of 1920 prices, and the results indicate that the cost of growing corn had increased to 165.5 per cent in 1919, while the average farm price of corn had increased 230 per cent on the basis of the average for the period 1910 to 1914. The 1920 price of wheat had increased very little more than cost of production, while with hogs and beef the increase had not nearly kept pace with the cost of production. Farmers in this section had generally shifted from less to more profitable lines of farming. Increased land values have more than made up for the high product price scale. Renting land has been advantageous. It is said, however, that rent rates are slowly adjusting themselves to the price situation.

A brief sketch of the strong and weak practices of the few exceptional farmers in each class are given.

The land ownership problem (*California Sta. Rpt. 1920, pp. 86–88*).—These pages give a summary statement prepared by E. Mead of some of the principles underlying a program of State aid to colonists and the activity of the college in connection with the administration of the California State Land Settlement Act.

Fortieth report of the Department of Lands [for New South Wales] (*N. S. Wales, Dept. Lands Rpt., 40 (1919), pp. 71, pls. 11*).—The year's operations in regard to land legislation, aid to farmers, lands made available and disposed of for soldier settlement, and other transactions by the department are reported. A number of soldier settlements are briefly described.

Report of subcommittee appointed to consider the employment of women in agriculture in England and Wales, L. WILKINS ET AL. (*Bd. Agr. and Fisheries [London], Rpt. Employment Women in Agr., England and Wales, 1920, pp. 121*).—This report is intended to indicate relatively and numerically the rôle of women workers in certain phases of English agriculture and the education required to fit them to meet present demands in the industry.

The conclusions are arrived at that there is the greatest lack of domestic servants and part-time workers, mainly local women relatives of men engaged in agriculture, and that social stimulation and local education in methods of working, labor saving, poultry raising, dairying, and cheese making is needed, especially for farmers' and small holders' wives and farm servants.

Farm practice in growing field crops in three sugar-beet districts of Colorado, S. B. NUCKOLS and T. H. SUMMERS (*U. S. Dept. Agr. Bul. 917 (1921), pp. 52, figs. 41*).—Records and estimates for the 1917 farm year were gathered in the summer of 1918, furnishing a basis for comparison of the requirements in labor, materials, and other costs, and the place in the rotation system of wheat, oats, barley, alfalfa, bean, potatoes, cantaloups, and cucumbers with those of sugar beets in three districts, in Larimer, Weld, Morgan, and Otero Counties, Colo., a study of which was previously noted (E. S. R., 40, p. 138). Three hundred and twenty-six crop enterprise records of the year noted, together with 46 potato records obtained in Weld County in 1912 and 1913, are used. Diagrams are given illustrating the labor distribution by months and the contract labor required in the production of each of these crops. The average numbers of man and horse hours required for the various farm operations in each of these districts are compiled and tabulated. Detailed account is given of practices commonly followed in the preparation of the seed bed, planting, application of manure, cultivation, irrigation, harvesting, and marketing with reference to the typical crops of the regions studied.

In figuring labor's share in the cost of producing farm crops, a universal rate of 30 cents per hour for a man and 20 cents an hour for a horse for the entire crop year was charged. In figuring the contract labor employed on beans, beets, potatoes, cantaloups, and cucumbers the actual amount paid out was considered rather than the number of hours spent in doing the work. Cantaloups show a total labor cost per acre of $99.07, beets $53.31 to $58.92, cucumbers $51.55, and potatoes $45.66. Alfalfa and the grains show the lowest expenditures for labor. A distribution of costs as percentages of the total indicates that the labor item is highest on cultivated crops, with the exception of potatoes, for which it is 36 per cent, while the expenditures for materials for potatoes amount to 43 per cent of the total, the highest percentage of this item for any crop. Alfalfa had the lowest percentage cost for materials. The grains, alfalfa, and beans show relatively high percentages for miscellaneous costs, including taxes and insurance, use of land and machinery, thrashing, and overhead.

The percentage distribution of total crop credits, or the receipts from sales of the crops combined with the estimated farm value for the portion used where grown, and of total crop receipts indicates the essential cash crops in each district. At Greeley and Fort Morgan these crops were beets, potatoes, and beans; at Rocky Ford, the potato crop is displaced by cantaloups, these three crops bringing in more than 75 per cent of all the receipts.

In conclusion, it is said that the distribution of labor in the three districts shows that sugar beets have a longer season than any of the other crops, and grains the shortest season. Each farm should have some acreage devoted to alfalfa, a grain crop, and one or more of the row-tilled crops

Numerous comments are made as to the better farm practices and the comparative labor requirements of the crops studied.

What the 1920 corn crop cost the Iowa farmers, R. Engberg (*Iowa Agr., 21 (1921), No. 10, pp. 396, 397, 420*).—The farm management department of the Iowa State College in cooperation with the Iowa Farm Bureau Federation is making a survey of the cost of producing corn on between 40 and 50 typical farms in each of seven Iowa counties. Data from Jones and Story Counties are reported here.

The average cost per bushel of corn on all farms on the owner basis was 91 cts. in Story County and 86 cts. in Jones County. Over half of the farms in each of these counties were growing corn at a cost greater than the average. The differences in the various items of cost between cash and share rented farms are shown. The cash renter in Story County produced corn 13 cts. a bushel and in Jones County 4 cts a bushel cheaper than the owner, owing largely to the charge of 5.5 per cent for the use of land, which amounts to more than the average land rent.

The share renter's cost of production was greater than that of the cash renter. It is pointed out, however, that each has certain advantages.

Cost of producing wheat and oats in Missouri, 1920, O. R. Johnson (*Missouri Sta. Circ. 100 (1920), pp. 4*).—From data briefly reported in this circular it is computed that the 1920 wheat crop cost the Missouri farmer \$2.26 a bushel and the oats crop 82 cts. a bushel. Less than one fifth of the crop would bring a price equal to cost of production at the October 1 prices for No. 2 wheat, whereas it is maintained that the market price should at least pay cost of production on 60 per cent to 70 per cent of the crop. Not one county could get the cost of production for its oats crop. Three-eighths of the Missouri wheat crop would have paid, at \$2.26 per bushel, cost of production plus 10 per cent profit, but only 5 per cent of the growers would have received cost of production plus 10 per cent at \$2.04 per bushel, which was the price on October 1, 1920. At labor prices then prevailing, it is held that cost of production can not be reduced enough to enable the wheat crop to be sold at a profit.

The cost of producing wheat and other crops in North Dakota in 1920, R. E. Willard, H. Metzger, and E. Skeem (*North Dakota Sta. Bul. 144 (1921), pp. 16*).—Estimates from groups of farms in 11 counties, an eastern and a western group, and records kept by farmers cooperating with the college furnished the data for this study, continuing one previously noted (E. S. R., 44, p. 190) Man and horse labor costs are calculated and tabulated. Separate charge for management is made on the basis of what this could be hired for and also upon the basis of what the farm operator would demand if he were employed under similar circumstances Machinery expenses and other items of cost, including an arbitrary charge for manure applied, twine, thrashing, insurance, and overhead, are allowed. In distributing the various farm costs, the relative size of the representative enterprises is used as the basis. In some cases man labor is used as the measure of size, while in others horse labor is the measure. For some costs "acres planted" are deemed the best basis.

Total acre costs of producing wheat in 1920 were found to be higher in the eastern group than in the western. In 1919 there was a greater difference in the same comparison, due chiefly to the very low yield in the western part of the State, the cost in the east averaging \$21.66 and in the west \$15.11. The average acre cost of wheat from 619 farmers' estimates was \$23.12 in 1920 as compared with \$20.54 in 1919, or \$2.45 per bushel in 1920 and \$2.75 in 1919. The cost ranged from \$1.05 to \$3.59 per bushel, but the bulk of the crop was produced at about \$2 a bushel or less. The costs of all the leading crops in North Dakota

were from $1 to $8 per acre higher in 1920 than in 1919, but the unit costs were lower in 1920.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul., 8 (1921), Nos. 42, pp. 10; 43, pp. 8*).—These numbers continue the partial list of products which farmers have for sale. No. 42 notes the organization of tobacco growers of North Carolina on the crop contract basis.

Readings in rural sociology, J. Phelan (*New York: Macmillan Co., 1920, pp. XIV+632*).—Excerpts and adaptations from numerous writers and from reports of commissions and official sources are brought together, those in the first three of the 20 chapters relating to certain social conditions characteristic of rural life in three sections of the United States, New England, the West, and the South. The remaining chapters include readings on the immigrant in agriculture, present problems of country life, some economic interests, mental and moral aspects of rural life, rural health—physical and mental, rural recreation, drama, art, communication and transportation, correctional agriculture and rural police, the rural home, the country school, other educational agencies, the country church, the village, the survey, the organization of rural interests, leadership, and the field of rural sociology. Extensive bibliographies are given for each of the chapters.

Rural Community Conference Cornell Farmers' Week, A. R. Mann et al. (*N. Y. Agr. Col. (Cornell) Ext. Bul. 39 (1919), pp. 203*).—A number of addresses delivered at this conference, held February 11–12, 1919, at the New York State College of Agriculture, considering the general theme of the war's effect on the rural community are given here. They include Social Responsibilities of the Rural Community, by A. R. Mann; How Can the Rural Community Americanize Its Immigrants? by W. C. Smith; What Does the Rural Community Owe to Its Children? by C. H. Johnson; The Report of the Children's Bureau on Juvenile Delinquency in Rural New York, by I. C. H. Cook, which is a comment on a report previously noted (E. S. R., 40, p. 390); How Shall the Rural Community Control Juvenile Delinquency? by H. I. Curry; The Need of Extending the Probation System in Rural Communities, by C. L. Chute; The Rural Community Nurse, by B. E McChesney; The War and Rural Health, by P. R. Bowdish; Is Civilian Relief Needed in Peace for Home Service in Rural Communities? by J. Hoey; Rural Recreation After the War, by C. F. Weller; The War's Challenge to the Rural Church, by E. deS. Brunner; How the Rural Sunday School May Aid in Community Betterment, by F. H. Beckwith; and The War and the Country Girl, by A. M. Clark.

The Nonpartisan League, H. E. Gaston (*New York: Harcourt, Brace, and Howe, 1920, pp. VII+325*).—A record is given of the beginning and growth of this attempt among working farmers in 13 western States to control State legislation and carry out a program of State ownership of terminal elevators, flour mills, packing houses, and storage plants; State inspection of grain and grain dockage; exemption of farm improvements from taxation; State hail insurance on the acreage tax basis; and rural credit banks operated at cost.

The account covers in detail incidents of its development in North Dakota, spread to neighboring States, becoming a national organization, and efforts of the opposition from early in 1915 to December, 1919. The league is characterized as a strictly political organization which has adopted the principle of uniform dues and paid memberships as a means of financing political activity, has adopted commercial methods of salesmanship by solicitors for enrolling its membership, and the aim of which "has been to free the market from abuses, to liberate the State from thralldom to great market and financial centers, to stimulate agriculture, to make rural life more agreeable and socially endurable,

to make it easier to acquire and to retain home ownership and productive independence, and to conserve so far as possible the wealth and production of the State for the people who live in it."

Theoretical bases of agricultural statistics, U. RICCI, trans. by P. SACO LANFRANCO (*Bol. Min. Fomento [Peru], Jan., 1920, pp. 31–87; Mar., 1920, pp. 3–66, fig. 1*).—This is a translation of chapters 14 to 27 of the volume previously noted (E. S. R., 31, p. 594), in regard to the adaptation of the systems of various nations to the use of index numbers expressing returns as variations from 100, the average for the last 10 years being the base.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7 (1921), No. 2, pp. 24*).—Monthly estimates of acreage and conditions, data on farm values, prices received by producers, and range of prices of agricultural products at important markets, as well as index numbers of crop yields, 1920, with comparisons, are given in this number. It is devoted mainly, however, to statistics relating to numbers and prices of live stock, meat production and consumption in the United States, and imports and exports of meat by 12 or 15 principal countries of the world through a period of years. Brief special articles give summaries of foreign crop prospects and of the effect of the World War on national surpluses of meat in various exporting countries.

Acreage and live stock returns of England and Wales, with summaries for the United Kingdom, R. J. THOMPSON (*Min. Agr. and Fisheries [London], Agr. Statis., 55 (1920), No. 1, pp. 53*).—These statistical tables with interpretative notes continue information previously noted (E. S. R., 43, p. 395).

Returns of produce of crops in Scotland, with a summary for the United Kingdom (*Agr. Statis. Scot., 8 (1919), No. 2, pp. [2]+59–79*).—The statistical information previously noted (E. S. R., 43, p. 95) is continued here.

Agricultural statistics of Czechoslovakia (*Czechoslovakia, Off. Statis. Etat. Manuel Statis., 1 (1920), pp. 41–52*).—Statistics for the cultivated area, and yields, numbers of live stock, and the area in forests, for a number of years and periods of years between 1895 and 1919, are published in these pages of a French edition of the preliminary statistical report, the first publication of the State Office of Statistics. The data are compiled from Austrian and Magyar reports for the earlier years and from statistical investigations by the Republic of Czechoslovakia for the later years.

[Agricultural statistics of Australia], G. H. KNIBBS (*Commonwealth Bur. Census and Statis. Aust., Prod. Buls. 12 (1919), pp. 9–71; 13 (1920), pp. 9–72*).—These reports continue the information previously noted (E. S. R., 40, p. 393).

AGRICULTURAL EDUCATION.

Cooperative extension work in agriculture and home economics, 1919 (*U. S. Dept. Agr., [Rpt.] Coop. Ext. Work Agr. and Home Econ., 1919, pp. 63*).—This is the fifth annual report (E. S. R., 42, p. 396) on the receipts, expenditures, and results of cooperative extension work in agriculture and home economics organized under the act of Congress of May 8, 1914, and similar work conducted under cooperative agreements between the U. S. Department of Agriculture, the State agricultural colleges, and local organizations.

A brief review of the development of this work for the five years 1915–1919 shows that the total funds annually available for the extension work increased from \$3,600,000 to \$14,000,000, the ratio of State and Federal funds for this purpose being 3:2. The average cost per agent increased between 40 and 50 per cent, and over 50 per cent of the funds available for extension work was used for county agricultural agent work. The proportion of the funds available for home demonstration work increased from 9 to 15 per cent, and for boys'

and girls' club work from 5 to 6 per cent. Only 2 per cent was used for the printing and distribution of publications, while the remainder was used for extension schools, the employment of subject matter specialists, and administration.

The number of persons employed in carrying on extension work increased from 2,700, of whom 65 per cent gave their entire time to it, to 6,000, of whom 88 per cent gave their entire time to it. The number of counties having the service of a county agricultural agent increased from 900, or over 30 per cent, to 2,250, or over 75 per cent, while the counties having demonstration agents increased from 275 to 1,050. The number of farmers reported as cooperating in the extension work increased from about 100,000 to over 275,000. The enrollment in boys' and girls' clubs increased from 250,000 to 614,000. The estimated value of the club products was $15,000,000 in 1919. It is noted that as the club work has developed the enrollment of girls has increased more rapidly than that of boys.

Fourth annual report to Congress of the Federal Board for Vocational Education, 1920 (*Fed. Bd. Vocat. Ed. Ann. Rpt., 4 (1920), pp. 542, figs. 22*).—This report deals with the promotion of vocational education in the States, including statistical tables with reference to the use of Federal and State funds.

A greater interest in vocational agricultural education and a better understanding of its problems is reported for 1919–20. A larger number of men and boys outside of high schools have been reached by short and part-time courses. There was an increase of 16 supervisors of vocational agriculture over the previous year, 36 States employing full-time supervisors and 12 States part-time supervisors. As compared with the previous year, the number of day schools giving instruction in vocational agriculture in 1919–20 increased from 863 with an attendance of 19,933 pupils and 1,201 teachers to 1,375 schools with an enrollment of 31,301 pupils and 1,570 teachers. Of the teachers 1,460 were employed for the 12 months of the year. There were also 117 part-time and short course agricultural classes with a total enrollment of 2,487 pupils, and 59 vocational agricultural evening schools with an enrollment of 1,541.

In all the States the land grant colleges have been designated as teacher-training institutions, there being 64 of the latter. The enrollment in teacher-training classes in agriculture increased from 1,334 with a teacher-training staff of 222 in 1918–19 to 2,348 with a staff of 293. The professional courses which have received the most emphasis have been the special methods courses and supervised practice teaching. In a few institutions the supervised practice teaching is conducted through a system of apprentice teaching, and the adoption of this method is apparently on the increase. Almost every State now makes provision for and requires improvement of the teachers in service.

In 1919–20 twenty-nine full-time, 21 part-time, and 5 assistant State supervisors of vocational home economics were employed as compared with 10 full-time and 34 part-time supervisors in 1918–19. The number of schools and classes in home making increased from 463 with an enrollment of 39,414 pupils and 1,433 teachers to 700 with an enrollment of 48,938 pupils and 1,637 teachers. In 38 States 193 evening centers with an attendance of 24,768 pupils, and 45 part-time classes with an attendance of 7,733 in 11 States were reported. Nineteen States had evening classes for the first time. In 13 States 12-month teachers are employed.

In its rehabilitation work the Federal board utilized during the year nearly 1,700 educational institutions. Agricultural training is with very few exceptions given at some agricultural college or school. Experience demonstrates, it is stated, that group instruction is more effective than individual personal

instruction, and that there is no difficulty in finding the necessary training on the job under actual employment conditions. In addition to the 5,397 disabled soldiers reported as having entered some line of agricultural training, nearly 1,000 men are classified under such headings as farm or tractor mechanics, agricultural chemistry, biology, bacteriology, bee culture, veterinary science, cotton grading, etc.

Accounts of distinctive rehabilitation work undertaken by the various districts are included.

Vocational education, L. N. HINES (*Ind. Dept. Pub. Instr. Rpt., 1919, pp. 17–29*).—This is a report on the progress of vocational education in agriculture, home economics, and the trades and industries in Indiana under the Smith-Hughes Act in 1918–19. Statistical tables are included.

Report of State supervisor of agricultural instruction, V. PETERSON (*S. C. Supt. Ed. Ann. Rpt., 51 (1919), pp. 64–87, figs. 4*).—This is a report on the progress of vocational agricultural education in South Carolina under the Smith-Hughes Act in 1918–19.

Report of the director of resident instruction for 1919–20, W. MULFORD (*Calif. Univ., Col. Agr. Rpt. 1920, pp. 126–137*).—This report includes a discussion of changes in educational policy in the College of Agriculture, University of California

The arrangement, effective in August, 1920, whereby instead of 17 major subjects, there will be only 6, viz, agricultural science, agronomy, animal industries, forestry, horticulture, and landscape gardening, is described. Under this plan a central core of studies, giving a broad view of the student's chosen field of work, is required in each major. The remainder of the courses consists of elective units which may be chosen both within the student's chosen field of work and outside of the college of agriculture. Two distinct types of training, namely, that of the student who plans to live on the farm and that of the future research worker and teacher are definitely recognized in this grouping. Other details have been previously noted (E S R, 41, p. 898)

Information relative to dairy manufactures courses and students taking them in thirty-one dairy departments of agricultural colleges in the United States, W P. B. LOCKWOOD (*Jour. Dairy Sci., 2 (1919), No. 6, pp. 509–514*).—Information is given with reference to the organization, the volume of business done, and the teaching, or subject matter, of dairy departments in 31 agricultural colleges visited by the author in the fall and winter of 1918–19. Statistics are also given with reference to the number of students taking dairy handling and manufactures work.

Productive farming, K. C. DAVIS (*Philadelphia and London: J. B. Lippincott Co., 1920, 4 ed., rev. and enl., pp. VIII+403+XXXIX, pl. 1, figs. 268*).—A fourth revised and enlarged edition of this text previously noted (E S. R, 38, p. 297). Chapters have been added on work with rope, the repair of farm equipment—handy devices, and power on the farm.

Agriculture and gardening for schools, L. S. IVINS (*Lebanon, Ohio: March Bros., 1920, pp. 215, figs. 11*).—This book is intended as a guide for teachers of agriculture and gardening and as a manual for students

Part 1 comprises an outline for teaching nature study and agriculture, including suggestive questions; a course of study in agriculture for a junior high school (seventh to ninth grades, inclusive) arranged in seasonal sequence; exercises in soils, plants, fruit, and how to raise fruit trees, etc.; practical contests for children; corn growing and judging by rural school boys; school exhibits; a course of study for rural schools (grades 1 to 8, inclusive), including nature study and agriculture; and 2-, 3-, and 4-year high school courses.

Part 2 is devoted to gardening, including outlines for the production and preservation of garden crops.

Nature-study agriculture, W. T. SKILLING (*Yonkers, N. Y.: World Book Co., 1920, pp. VII+332, figs. 266*).—This text includes chapters on soils; the nature, food, propagation, and care of plants; the improvement of crop plants; farm management and farm crops; vegetable gardening; ornamental gardening; dry farming and irrigation; insect enemies and allies; useful birds; bacteria and fungi; the herd and the dairy; farm animals and the principles of feeding; and poultry keeping. Each chapter concludes with a list of suggested experiments and observations, and of references to helpful literature.

How to teach canning and jelly making in rural schools, C. A. LYFORD and A. KRUSE (*Hampton Leaflets, 1920, No. 103, pp. 42*).—Instructions are given for the use of the rural school teacher in offering courses in the principles and methods of canning and jelly making to the older girls in the school and to the housekeepers of the community.

The preparation of a dairy exhibit, W. B. NEVENS (*Jour. Dairy Sci., 2 (1919), No. 5, pp. 415–429, figs. 7*).—Directions for the preparation of a college dairy exhibit are given.

Filing agricultural bulletins and circulars, H. DURHAM (*Kansas Sta. Circ. 85 (1921), pp. 13, figs. 3*).—The author describes and discusses two methods of filing agricultural bulletins and circulars, for the use of the farmer or teacher of high school agriculture, viz, by classifying the publications by subjects, and by a card index system.

MISCELLANEOUS.

Thirty-third Annual Report of Alabama College Station, 1920 (*Alabama Col Sta. Rpt. 1920, pp. 32*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, and reports of the director and heads of departments on the work of the station during the year. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of California Station, 1920 (*California Sta. Rpt. 1920, pp. 7–125, fig. 1*).—This contains a report of the director discussing in some detail the relation of the California Station to the State, the place of the station in the university organization and the college of agriculture, and the organization of station work, together with a summary of the results of investigations during the year. Lists of the various station projects and publications of the year, and a discussion of some important problems demanding investigation, are appended. The experimental work reported is for the most part abstracted elsewhere in this issue.

Twenty-eighth Annual Report of Minnesota Station, 1920 (*Minnesota Sta. Rpt. 1920, pp. 91*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, and reports of the director, heads of divisions, and the various substations. The experimental work not previously reported is for the most part abstracted elsewhere in this issue.

Annual Report of Pennsylvania Station, 1917 (*Pennsylvania Sta. Rpt. 1917, pp. 516, pls. 143*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1917, a report of the director on the work and publications of the station during the year, departmental reports, reprints of Bulletins 146 and 147, previously noted, and many special articles. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of Virginia Station, 1919 (*Virginia Sta. Rpt. 1919, pp. 64, figs. 3*).—This contains the organization list, a report of the director on the work

of the station, several special articles, and a financial statement for the fiscal year ended June 30, 1919. The experimental work reported is for the most part abstracted elsewhere in this issue.

The work of the Huntley Reclamation Project Experiment Farm in 1919, D. HANSEN (*U. S. Dept. Agr., Dept. Circ. 147 (1921), pp. 27, figs. 5*).—This report includes a discussion of agricultural conditions on this project and the extent and character of the work carried on during the year at this farm, located near Osborn, Mont. The experimental work reported is for the most part abstracted elsewhere in this issue. Data are also summarized as to acreage, yields, and farm values of crops produced on the project and the number of live stock.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul., 5 (1920), No. 11-12, pp. 273-303, figs. 10; 6 (1921), No. 1-2, pp. 32, figs. 15*).—These numbers contain, in addition to several articles abstracted elsewhere in this issue and miscellaneous notes, the following:

No. 11-12. Answers to Timely Questions; and the volume index.

No. 1-2. Seeding Card for Farm Crops; and Annual White Sweet Clover, by L. E. Thatcher.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 8 (1921), No. 11, pp. 165-180, figs. 3*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Rhubarb Culture, by J. L. Stahl; Profitable Fertilization and Applying Fertilizers, by M. E. McCollam; Breeding Stock and Its Relation to the Poultry Industry, by Mr. and Mrs. G. R. Shoup; and Farm Butter Making, by H. E. McNatt.

NOTES.

Iowa College and Station.—W. H. Stevenson, head of the department of farm crops and soils and vice-director of the station, has been granted a year's leave of absence to accept an appointment as representative of the United States on the permanent committee of the International Institute of Agriculture at Rome. Prof. Stevenson will succeed Dean T. F. Hunt, of the University of California, who has been occupying the position during his sabbatical leave.

Kansas College and Station.—State appropriations for the ensuing biennium have been granted aggregating $2,380,000, together with $40,000 as a revolving fund for emergency use, $43,000 for the Fort Hays Substation, and $14,000, $5,000, and $4,000 for the substations at Garden City, Colby, and Tribune, respectively. Of the college appropriations, $275,000 will be available for the construction of the west wing of the agricultural building, $125,000 for a cafeteria and printing plant, $100,000 for the central portion of a veterinary clinic building, $52,000 for the purchase of about 250 acres of additional pasture land, and $10,000 for studies of contagious abortion The remainder of the appropriations is largely for salaries, maintenance, and repairs.

Construction work on the new wing of the agricultural building will commence as soon as the plans are completed. The wing will house the departments of dairy husbandry agricultural economics, and poultry husbandry, and a part of the work of the departments of agronomy and animal husbandry, including a meats laboratory and creamery.

Tentative arrangements have been made for an investigation in cooperation with the Office of Farm Management and Farm Economics, U. S. Department of Agriculture, of the economics of meat production and pasture utilization in the Flint Hills region of Kansas. The investigation is to be conducted chiefly by the "route" method, and will be concerned largely with extensive summer pasturing operations which involve the use of large numbers of beef cattle grown in Texas and Oklahoma and pastured in Kansas one season before reaching the market. H. J. Henney has been appointed research assistant in agricultural economics and will be in local charge of the investigation.

A night school for millers was held once a week for 16 weeks during the past winter at Kansas City, Kans., under plans adopted by the department of milling industry. The program consisted of weekly lectures and discussions of milling problems. The average attendance was about 50, consisting of millers and milling employees in the Kansas City district.

Miss Leila Dunton, associate professor of milling industry, has resigned. Leave of absence has been granted to C. O. Swanson of the department of chemistry, and W. E. Grimes of the department of agricultural economics. Eric Englund has been appointed associate professor of agricultural economics.

Cornell University and Station.—Under the appropriation bill recently approved by the Governor, the college of agriculture has been granted about $1,250,000.

The dairy department has recently installed a glass-lined 500 gal. milk tank for storage and manufacturing purposes. The department of poultry husbandry has ordered a 10,000-egg incubator equipped with an electric fan and other modern improvements.

Under a bequest by August Heckscher of New York City $500,000 was left in 1920 to the university for the promotion of research. A small portion of this fund has been made available for studies of a tractor dynamometer by the department of rural engineering.

Approximately 25 new fruit growers' and fruit packers' associations are being formed in the State with the assistance of the department of pomology. It is estimated that the facilities for packing the tree fruits of the State next fall will be about double those of last year.

About 120,000 trees have been planted by forestry students in Otsego County under the direction of the department of forestry.

The agricultural economics club, an organization of graduate and undergraduate students and faculty members, is contemplating affiliation with similar organizations in about forty other institutions to carry on studies and discussions of agricultural economics subjects with a view to the publication of the findings.

According to a note in *Science*, Dr. Lewis Knudson of the department of botany has been granted leave of absence to assist in establishing departments of plant physiology in the Universities of Madrid and Barcelona. Leave of absence has also been granted for the ensuing academic year to H. H. Whetzel, G. W. Cavanaugh, R. S. Hosmer, K. M. Wiegand, A. B. Recknagle, Blanche Hazard, Anna B. Comstock, and E. W. Benjamin. It is expected that Professor Whetzel will assist in organizing a plant pathology service for the Bermuda Islands, and that Professor Hosmer will make a study of forest conditions in England, France, Switzerland, Sweden, and Norway.

Utah College and Station.—The legislature has appropriated for the station $115,000 for the ensuing biennium, an increase of $15,000. The college receives $145,334 for special maintenance, $3,200 for improvements, and $9,000 for purebred live stock. The extension division receives $128,000.

A tract of 34 acres has recently been added to the irrigated experimental farm at Logan under an appropriation made two years ago. The new land will be used for forage crops, fertility and orchard experiments.

A rabbit-proof fence is to be erected around the Kane County experimental dry-farm. Indications are that this area is quite promising for dry farming but on account of the destruction of the crops by rodents no accurate results have thus far been obtained.

Dr. Franklin S. Harris has resigned as director of the station to become president of the Brigham Young University. His resignation is effective September 1, on which date he will be succeeded by William Peterson, professor of geology and director of interior institutions. Other appointments include Dr. Ira M. Hawley of Cornell University as professor of zoology and entomology and entomologist; Sherwin Maeser, Ph.D., as associate professor of chemistry; and Henry Peterson, at present superintendent of the Logan City schools, as head of the department of education, a position established by the last legislature.

R. L. Judd, J. H. Waters, and E. O. Howard of Salt Lake City, and O. H. Budge and C. P. Cardon of Logan have been appointed to the board of trustees, vice John C. Sharp, deceased, and Lorenzo N. Stohl, George T. Odell, A. G. Barber, and George W. Skidmore, whose terms have expired.

Agricultural Experiment Stations and Demonstration Farms in Yugoslavia.—The U. S. Consul at Belgrade announces that two American manufacturers of agricultural machinery have combined in an effort to introduce modern American agricultural machinery into Yugoslavia. They have secured the cooperation of the "Gospodarska Zadruga," an association of agricultural cooperative societies throughout the Kingdom, and three permanent agricul-

tural experiment stations under the auspices of the association will be established in those Provinces which were formerly a part of Austro-Hungary.

The largest of these stations will cover 1,000 hectares (2,471 acres) and will be located at Osjek, serving the Banat and the Backa. The station for Croatia will be in the neighborhood of Zagreb and will cover 100 hectares. The location of the third station has not been definitely determined, although Pozega and Vinkovci are being considered. This station will probably comprise about 400 hectares and will serve Slavonia.

These experimental fields will be in charge of American experts who will demonstrate the uses of American tractors, thrashing machines, and other modern farm equipment. The harvesting machinery has already been sent for use during the current year.

According to a note in *World Agriculture* the American Institute and Health Center of the Serbian Child Welfare Association at Chachak has established a demonstration farm under the direction of Howard A. Julie of New Jersey. A tract of 250 acres is under cultivation as a home for orphaned boys and a demonstration of what can be accomplished by the use of American methods and farm implements.

British Investigations of Foot-and-Mouth Disease.—*Science* notes that the British Ministry of Agriculture and Fisheries is arranging a series of exhaustive investigations of foot-and-mouth disease. For this purpose it is planned to transfer a number of obselete warships from the Admiralty to the Board for use as a floating laboratory, thereby minimizing the risk of spreading this extremely contagious disease. It is expected that the investigations will include members of the Ministry staff and other scientists, including several from foreign countries, and that the research may last for several years.

Tenth Anniversary Celebration of the Establishment of the First Farm Bureau.—Exercises commemorating the tenth anniversary of the employment of the first county agent in the Northern and Western States and the establishment of the first farm bureau were held in Binghamton, N. Y., March 21.

The program included addresses by Dean A. R. Mann of the College of Agriculture of Cornell University, President John R. Howard of the American Farm Bureau Federation, the president of the State Farm Bureau and Home Bureau Federations, and others, and the presentation of a pageant entitled The Growth of an Idea. This pageant depicted several steps in the development of the farm bureau movement, from its beginning as a bureau of the Binghamton Chamber of Commerce and the Lackawanna Railroad with only two farmers as members, to its full evolution as an organization primarily of farmers. Most of the leaders in the movement participated in the pageant in person.

Necrology.—Dr. James Law, widely known as a pioneer in veterinary education in this country, died May 10 at the age of 83 years.

Dr. Law was a native of Scotland, was educated in Edinburgh Veterinary College, the University and College of Surgeons, and the veterinary schools of Alfort and Lyons in France, and served on the faculties of the Edinburgh New Veterinary College and the Albert Veterinary College of London. In 1868 he became professor of veterinary science at Cornell University, continuing in this capacity until 1896 when he was appointed director and dean of the New York State Veterinary College, established at the university. He retired from active service in 1908 as director and dean emeritus, and had been living in Ithaca, N. Y., since that time.

Dr. Law also served as consulting veterinarian of the New York State Agricultural Society from 1868 to 1896, as chairman of the U. S. Treasury Cattle Commission in 1882–83, and as field chief of the Bureau of Animal Industry

of the U. S. Department of Agriculture during the campaign against pleuropneumonia in Illinois and New York in 1887–88. He was the author of a treatise entitled General and Descriptive Anatomy of Domestic Animals, published in 1861–62; The Farmers' Veterinary Adviser, published in 1876; and a Textbook of Veterinary Medicine, a five volume issued from 1905 to 1911. In 1906–07 he served as president of the American Veterinary Medical Association.

In an editorial tribute to Dr. Law, the *Ithaca Journal-News* summarized his achievements as follows:

"Dr. Law's attainments as a scholar and his experience in both teaching and practice in Scotland and England prepared him for the work he was destined to do in America. When he entered upon his duties at Cornell University in 1868 he began at once to lay the foundation for a veterinary profession. He recognized that the animal husbandry of this country would soon require the services of a large number of scientifically trained veterinarians to combat the numerous destructive diseases of live stock that were beginning to gain a foothold here. For years he stood alone for higher veterinary education and adequate live stock sanitation. By his influence and personal efforts the first State-supported veterinary college was established at Cornell University. Through his students of earlier years, over whom he had a profound influence, the Federal Bureau of Animal Industry was organized in 1884 and live stock sanitary boards were created in many States. His services were sought frequently by State and Federal authorities whenever epizootics of a serious nature appeared. He has contributed more than any other man to the protection of our animal husbandry and the development of veterinary education in the United States."

Spencer U. Pickering, well known for his work at the Woburn Experimental Fruit Farm, England, on the deleterious effect of grass on young fruit trees and his investigations on proper strength of Bordeaux mixture, died at Harpenden, December 5, 1920, at the age of 62 years.

Director Pickering was educated at Eton and Balliol, and was appointed professor of chemistry at Bedford College in 1881. His early studies were in chemistry, dealing especially with the construction of double and basic salts and the thermal phenomena accompanying the formation and solution of salts. In 1894 he designed a series of experiments in fruit growing and persuaded the Duke of Bedford to set up a trial garden at Ridgemont in Bedfordshire. Two years later he turned to horticultural experimentation exclusively, carrying on extended studies of nearly all phases of fruit growing, but notably those on the effect of grass on tree growth, pruning methods of planting, fertilizing, and insecticides. His conclusions were embodied in a final volume, Science and Fruit Growing, published in 1919.

Although he was handicapped by soil unsuitability and other difficulties, and many of his conclusions were subject to much controversy, his reviewer in *Nature* claims that "the Woburn trials will remain as the most substantial contribution of the last hundred years to the study of fruit-tree development—one full of stimulus to new workers."

The death of Director Pickering was followed by the closing of the Woburn Fruit Farm at the end of the year.

T. Miyake, professor of zoology of the Agricultural College of the Imperial University of Tokyo, died February 2. Professor Miyake was well known as a writer on entomological topics including a two-volume work on Entomology of Japan, recently published.

EXPERIMENT STATION RECORD.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

A dictionary of chemical terms, J. F. COUCH (*New York: D. Van Nostrand Co., 1920, pp. IV+204*).—This dictionary gives definitions of selected chemical terms, particularly those which have been recently introduced and are not given in the ordinary dictionary.

Proceedings of the thirty-fourth annual convention of the Association of Official Agricultural Chemists, 1917 (*Jour. Assoc. Off. Agr. Chem., 4 (1920), Nos. 1, pp. 155, fig. 1; 2, pp. 157–298, figs. 3*).—This detailed report of the 1917 convention of the association includes, in addition to the usual reports and recommendations of the referees and papers abstracted elsewhere in this issue, the presidential address by J. K. Haywood on Insecticide and Fungicide Legislation in the United States, with Especial Reference to the Federal Insecticide Act of 1910 (pp. 11–38); the address by the honorary president, H. W. Wiley (pp. 184–193); and papers on Double Moisture Determinations in Fertilizer Materials, by J. O. Clarke (pp. 57–59); the Effect of Mass and Degree of Fineness on the Percentage of Available Phosphoric Acid in Precipitated Phosphate, by H. D. Haskins (pp. 64, 65); The Use of Permanganate in the Kjeldahl Method Modified for Nitrates and Investigation of the Kjeldahl Method for Determining Nitrogen, both by I. K. Phelps (pp. 69–76); Excavation Method for Determining the Apparent Specific Gravity of Soils, by W. Frear and E. S. Erb (pp. 103–105); A New Method for the Estimation of Histidin, by W. E. Thrun and P. F. Trowbridge (pp. 194, 195); and A Note on the H-ion Concentration at which Iron is Precipitated from Hydrochloric Acid Solution by Ammonium Hydroxid, Sodium Hydroxid, and Hydrogen Sulphid, and Note on the Behavior of Neutral Ammonium Citrate in Certain Phosphate Solutions, both by H. E. Patten and G. H. Mains (pp. 233–237).

Studies of cranberries during storage.—Chemical studies, F. W. MORSE and C. P. JONES (*Massachusetts Sta. Bul. 198 (1920), pp. 75–87, fig. 1*).—Analyses of several varieties of cranberries for moisture, total sugar, and total acid under different conditions of storage are reported, together with the results of respiration experiments indicating the amount of CO_2 exhaled by 1 kg. of cranberries in 1 hour when held at temperatures varying from 1 to 25° C.

The principal change in composition of the cranberries during storage was a progressive loss of sugar which increased with the temperature. Berries stored in tight containers without access of air deteriorated much more rapidly than when well ventilated. This is explained as a form of asphyxiation resulting from excess CO_2 formed during the respiration of the berries. As too rapid respiration results in a loss of sugar and incomplete respiration, result-

ing from lack of oxygen or excess of CO_2, brings about too rapid deterioration, the authors conclude that good storage of cranberries must include control of both ventilation and temperature.

Attempts to use frosted cranberries as a source of vinegar were unsuccessful. A brief description is given of the methods used in the chemical and respiration experiments, with a diagram of the respiration apparatus employed.

The oil of the prickly pear seed, S. Lomanitz (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, p. 1175*).—Analysis of the seeds of a semicultivated variety of white prickly pear known in Mexico as "tuna blaca de huerta" showed them to contain 7.68 per cent of moisture, 2.96 of ash, and 10.89 of oil. By extracting the seeds with petroleum ether a greenish yellow, odorless, and somewhat viscous oil was obtained with the following constants: Specific gravity (15.5/15.5) 0.9294, acid number 3.09, free fatty acids as oleic acid 1.55, saponification value 189.5, iodin number 116.3, ester number 186.47, Reichert-Meissl number 2.8, Hehner number 93.81, and index of refraction 1.46764.

These data indicate that the oil belongs to the group of semidrying oils, and if produced in sufficient quantities might be used in some of the oil-products industries.

Kryptocyanins.—A new series of photosensitizing dyes, E. Q. Adams and H. L. Haller (*Jour. Amer. Chem. Soc., 42 (1920), No. 12, pp. 2661–2663*).

Organic chemical reagents, R. Adams, O. Kamm, and C. S. Marvel (*Ill. Univ. Bul., 16 (1919), No. 43, pp. 79, figs. 6*).—This bulletin contains descriptions of methods which were adopted at the University of Illinois for the preparation of some of the less common organic chemicals which were unavailable during the early part of the war. An attempt has been made to use methods adaptable to large-scale production as far as possible. With each preparation a bibliography of the known synthetic methods is given. Attention is called to the importance of mechanical stirring, and an apparatus is described and illustrated which can be used wherever refluxing and stirring at the same time are necessary.

A note on the determination of diastatic activity, E. I. Rosenblum (*Jour. Soc. Chem. Indus., 39 (1920), No. 20, pp. 311T–313T*).—The addition of 0.5 per cent of ammonium dihydrogen phosphate is considered by the author to favor the determination of diastatic power of digestion of starch solution by the Harrison and Gair method,[1] in that it establishes a favorable and constant H-ion concentration and neutralizes the varying reactions of different starches caused by the acid salts they contain.

A new method for moisture determination, G. F. Lipscomb and W. D. Hutchins (*Jour. Assoc. Off. Agr. Chem., 4 (1920), No. 1, pp. 55, 56, fig. 1*).—A rapid method for determining moisture in fertilizing materials is described which is said to give results comparable with those of the Official method. The procedure consists essentially in heating the sample by means of live steam and collecting the moisture in a vacuum cooled to −100° C. by a mixture of solid carbon dioxid and ether. The apparatus employed is illustrated, and the technique of the method is described in detail.

Determination of moisture in field samples of soil, H. A. Noyes and J. F. Trost (*Jour. Assoc. Off. Agr. Chem., 4 (1920), No. 1, pp. 95–97*).—Data obtained at the Indiana Experiment Station on moisture determinations in samples of soil of different weights are presented which indicate that the weight of a particular soil necessary for an accurate moisture determination depends on the soil, the amount of moisture present, and the technique of the person making the analysis. The advisability is suggested of ascertaining by prelimi-

[1] Pharm. Jour. [London], 4. ser., 77 (1906), pp. 94, 95.

nary tests the weights of different types of soil that must be taken to have the moisture results agree to 0.1 per cent.

Technique of determination of soil phosphorus, H. A. Noyes (*Jour. Assoc. Off. Agr. Chem., 4 (1920), No. 1, pp. 93, 94*).—A technique for preparing soil solutions for phosphorus determinations with ammonium molybdate, which has proved satisfactory for the determination of the phosphorus variations of soils investigated at the Indiana Experiment Station, is described as follows:

A 10-gm. sample of the prepared air-dry soil is digested in a 250 cc. graduated Kjeldahl flask by the regular Kjeldahl method, using 0.7 gm. of mercuric oxid and a crystal (about 0.5 gm.) of pure sodium or potassium nitrate to complete the oxidation. After partially cooling and making up to volume with water, the solution is filtered by pouring the entire contents of the flask on the filter and pouring back the filtrate until it comes through clear. Twenty-five cc. of the filtrate is pipetted into a 250 cc. beaker, 15 gm. of dry ammonium nitrate is added and dissolved by heating to boiling, and finally 30 cc. of ammonium molybdate solution is added with constant stirring. The beaker is placed on a water bath at 60 to 65° C. for one hour, after which the procedure is continued by the Official method.

The determination of calcium in the presence of phosphates, J. F. Breazeale (*Jour. Assoc. Off. Agr. Chem., 4 (1920), No. 1, pp. 124–134*).—The method described, which is designed for calcium determinations in the ash of plants and similar materials containing phosphates, depends upon the conversion of calcium phosphate into insoluble calcium oxalate by the action of dilute oxalic acid, while the phosphates of iron and magnesium which may be present form soluble oxalates. If manganese is present it is precipitated as the oxalate along with the calcium, and is separated from the calcium oxalate by dissolving the precipitate in excess HCl and reprecipitating the calcium with ammonia and ammonium oxalate. The calcium in either case is finally determined by igniting and weighing as CaO, or by dissolving the precipitate in H_2SO_4 and titrating with standard potassium permanganate.

Tests of this method are reported which show that by keeping the solution down to a small volume an accurate determination of calcium can be made in amounts as low as 0.0005 gm. in the presence of an excess of phosphates. The data reported also include tables showing the solubility of calcium oxalate in oxalic acid and in different salts. It was found to be practically insoluble in cold solutions of oxalic acid, soluble to the extent of about 20 parts per million at a concentration of 30 per cent of oxalic acid at boiling temperature, practically insoluble in the presence of oxalic acid in ammonium nitrate or chlorid at any ordinary concentration, slightly soluble in ammonium sulphate, soluble in pure sodium salts, but insoluble in sodium salts in the presence of oxalic acid.

Some results of the determination of potash by the Lindo-Gladding method, H. C. Moore and R. D. Caldwell (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, pp. 1188, 1189*).—Attention is called to the fact that the use of 80 per cent ethyl alcohol, as prescribed in the Official method of determining potash by the Lindo-Gladding procedure, gives lower results than the use of 95 per cent alcohol. This discrepancy in results is shown to be due, in part at least, to the presence in ordinary potassium chlorid of sodium salts. The sodium salts, being more soluble in 80 per cent alcohol than in 95 per cent, give an alcoholic solution of sodium salts which has a greater solvent action on the potassium platinic chlorid than the alcohol alone.

It is thought advisable that further study be made of the effect of other salts and other concentrations of alcohol. The data already obtained are considered to warrant "the suggestion that the Official method be changed

at least to allow the use of the strong alcohol, about 95 per cent, for the first washings to remove excess platinic chlorid, and the 80 per cent alcohol for final washing, if this is considered necessary; then if there is anything present which 80 per cent alcohol should remove and which 95 per cent alcohol will not remove, it can be done in the final washing without including the effect of sodium or other salts."

A modified method for the determination of water-soluble potash in wood ashes and treater dust, H. D. HASKINS (*Jour. Assoc. Off. Agr. Chem., 4 (1920), No. 1, pp. 82–84*).—The author, at the Massachusetts Experiment Station, suggests as a modification of the Official method of determining water-soluble potash in wood ashes, the preliminary treatment of the ashes for two days at room temperature with just enough water to cover, after which the samples are washed with successive portions of boiling water and the manipulation continued according to the Official method.

Results of analyses by the two methods of 1 sample of treater dust and 21 samples of wood ashes indicate that the freshly made dry ashes and dry treater dust yield appreciably more water-soluble potash by the modified than by the Official method.

The influence of potassium permanganate on Kjeldahl nitrogen determinations, D. C. COCHRANE (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, pp. 1195, 1196*).—Attention is called to a paper read by W. Frear at the 1915 meeting of the Association of Official Agricultural Chemists, in which the accuracy of the Kjeldahl method for nitrogen in fertilizer analyses was questioned on the basis of data showing a large loss of nitrogen in Kjeldahl determinations on fertilizers when potassium permanganate was added. To check this method on substances dealt with in nutrition work duplicate Kjeldahl determinations were made on a number of samples of feeding stuffs and feces, with and without the addition of potassium permanganate.

The results obtained in determinations made without the addition of permanganate were uniformly lower than those in which the permanganate was used. As an explanation of this discrepancy it is suggested that a loss of nitrogen may occur on addition of permanganate, but that this has been compensated, at least in the materials used in the present study, by the more effective oxidation of the organic matter through the addition of the permanganate.

The comparative evaluation of total nitrogen in urine by the Dumas and Kjeldahl methods, W. MESTREZAT and M. P. JANET (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 21, pp. 1019–1021*).—Comparative results of determinations of total nitrogen in pathological urines by the Dumas and Kjeldahl methods are reported which show higher values for the former than the latter. This is thought to indicate the existence in the urine of nitrogenous compounds which escape oxidation by H_2SO_4, and the nitrogen of which is consequently not included in the Kjeldahl determination. The authors conclude that, notwithstanding the greater difficulty of technique, the Dumas method should be used in urological work and in nitrogen balance determinations in pathological conditions.

Quantitative determination of ammonia in urine, in serous liquids, and in the digestion products of the Kjeldahl determination, A. HAHN and E. KOOTZ (*Biochem. Ztschr., 105 (1920), No. 4–6, pp. 220–228, figs. 2; abs. in Chem. Abs., 14 (1920), No. 21, p. 3255*).—A rapid method of ammonia determination is described in which the ammonia is set free by the action of sodium carbonate, heat and aspiration being used to hasten the reaction and collection of the ammonia in the standard acid. The technique is described of the procedure for ammonia determinations in urine, blood serum, and Kjeldahl digests.

The iodometric determination of amino nitrogen in organic substances, H. H. WILLARD and W. E. CAKE (*Jour. Amer. Chem. Soc., 42 (1920), No. 12, pp. 2646–2650*).—Modifications in the Kjeldahl method of determining nitrogen are described. These consist in the addition of potassium persulphate to the cold charred solution of organic matter in concentrated sulphuric acid to hasten the oxidation, and in the subsequent determination of the ammonium salt by the oxidation of the ammonia to nitrogen in alkaline solution with standard hypobromite, the excess of the latter being determined by adding potassium iodid and acid and titrating the liberated iodin with thiosulphate.

The technique of the method is described in detail, together with precautions that must be taken to insure accuracy of results.

The use of ethyl acetate as a precipitating reagent for proteins, A. MARIE (*Ann. Inst. Pasteur, 34 (1920), No. 3, pp. 159–161*).—Attention is called to the fact that ethyl acetate precipitates proteins from dilute solutions of blood serum, peptone, etc., and the suggestion is made that it may possibly prove of value as a protein precipitant in place of other reagents such as acetone.

Standard methods for the examination of water and sewage (*Boston: Amer. Pub. Health Assoc., 1920, 4. ed., pp. VII+115, fig. 1*).—In this revision no changes from the preceding edition (E. S. R., 37, p. 311) have been made in the chemical methods, but a few important changes are noted in the methods for preparing and standardizing culture media.

Babcock testing of milk and cream, C. F. HOYT (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 10–11, pp. 542, 543, fig. 1*)—A method devised by O. G. Simpson for calibrating Babcock test bottles is described, with an illustration of the apparatus employed. This consists of a metal tube 4 ft. in length and filled with mercury. At the middle of the tube is an opening into which the mouth of an inverted Babcock test bottle can be fitted. At one end of the mercury tube in an adjustment screw, which is used to bring the mercury to the level of the zero mark in the test bottle. The other end of the tube is provided with a plunger, accurately adjusted to displace given amounts of mercury. By sliding this plunger fixed distances into the tube, mercury corresponding to given percentages on the Babcock scale is forced into the bottle. By comparing the level with the corresponding graduation on the bottle the apparatus may be easily calibrated.

The direct identification of soy-bean oil, C. A. NEWHALL (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, pp. 1174, 1175*).—The color test described is a modification of one suggested by Settimj (E. S. R., 30, p. 413), and consists in mixing 5 cc. of chloroform with 5 cc. of the oil, a few drops of gum arabic solution, and 5 cc. of a 2 per cent solution of uranium nitrate or acetate. On shaking thoroughly, a characteristic lemon-yellow emulsion is formed with all samples of crude and refined imported soy-bean oil, but not with bleached and deodorized bean oil, hydrogenated oil, bean oil fatty acid, or with any other oils thus far tested.

The test has been found of value in the detection of admixture of the cheap bean oil with wood oil or linseed oil. In the former case it has been found possible by comparison with standards of varying amounts of pure wood oil and pure bean oil to detect as small an amount as 5 per cent of the bean oil. The test is said to be not quite so sharp with linseed oil. It is pointed out that the test has been used only with imported oils and may be characteristic of only certain varieties of soy bean.

The determination of sucrose in the presence of both invert sugar and raffinose, W. MONTGOMERY (*Internatl. Sugar Jour., 22 (1920), No. 232, pp. 580–582; abs. in Chem. Abs., 15 (1921), No. 2, p. 322*).—A formula and tables of factors are given by which it is possible to determine the amount of sucrose, invert

sugar, and raffinose in a mixture of the three with the use of the polarization and copper reduction methods.

New observations on saccharin analysis, O. Beyer (*Chem. Ztg., 44 (1920), No. 71, pp. 437, 438*).—This is a summary of recent contributions to saccharin analysis, both from the author's laboratory and from other sources, including a new method for the qualitative determination of sulfinid and its detection in various saccharin preparations, data on the content of sulfinid in different commercial preparations, a method for approximating the sweetness of artificial sweetening agents, a note on the variations in specific gravity of commercial saccharins, and a revised formula for determining the content of saccharin in such preparations. Earlier studies by the author on saccharin have been previously noted (E. S. R., 42, p. 613; 43, p. 12).

A new reaction of saccharin, L. Thevenon (*Jour. Pharm. et Chim., 7. ser., 22 (1920), No. 11, pp. 421, 422*).—A sensitive color reaction for detecting saccharin in food materials is described, consisting essentially in the diazotization of the saccharin and the union of the diazonium salt thus formed with β-naphthol, yielding an intense and brilliant red color.

Naphthalene sulfonic acids.—III, An alternative method for the qualitative detection of naphthalene-2, 7- and 1, 6-disulfonic acids, J. A. Ambler (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, pp. 1194, 1195*).—This is a continuation of studies previously noted (E. S. R., 44, p. 711).

A composite reagent for the determination of sodium chlorid in urine, H. V. Atkinson (*Jour. Lab. and Clin. Med., 6 (1920), No. 3, p. 160*).—A composite reagent which has been found useful in the determination of sodium chlorid in urine consists of 6.67 gm. of silver nitrate, 75 gm. of ferric ammonium alum, 150 cc. of concentrated nitric acid, and water to 1,000 cc. The determination is made by placing 90 cc. of this reagent in a glass-stoppered 100 cc.-cylinder, adding 10 cc. of urine from a pipette, shaking, and allowing to stand for a few minutes, after which 50 cc. of the approximately clear solution is pipetted off and the excess of silver nitrate titrated with the usual ammonium thiocyanate solution, 1 cc. of which is equivalent to 0.01 gm. of sodium chlorid.

The preservation of blood, C. Oppenheimer (*Biochem. Ztschr., 105 (1920), No. 1–3, pp. 145–154*).—A study of various methods of preserving blood to be dried and used in food preparations is reported. The best results were obtained with the use of a solution of sodium sulphite with the addition of sufficient oxalic, tartaric, or hydrochloric acid to liberate the sulphur dioxid.

Colorimetric procedure for the determination of uric acid in blood, A. Grigaut (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 28, pp. 1273, 1274*).—The method is based on the blue color given by uric acid with the phosphomolybdic reagent of Folin and Denis, the test being applied directly to the blood filtrate after removal of proteins.

The analysis of resins, balsams, and gum resins, K. Dieterich (*London: Scott, Greenwood & Son, 1920, 2. ed., rev. and enl., pp. XVI+431*).—This is a revision by H. B. Stocks of the first English edition of this book by Salter (E. S. R., 14, p. 546).

The thermal decomposition of turpentine with particular reference to the production of toluene and isoprene, S. A. Mahood (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, pp. 1152–1155, figs. 3*).—This contribution from the U. S. Forest Products Laboratory, Madison, Wis., consists of a study of the yields of isoprene and toluene in the cracking of turpentine at different temperatures. The results obtained indicate that although turpentine is a possible source of toluene in case of emergency, it does not give a sufficiently

large yield of either toluene or isoprene to make it a practical source of these products under ordinary conditions.

The manufacture of table sirup, C. W. HINES (*Philippine Agr. Rev., 11 (1918), No. 4, pp. 261–270, pls. 3*).—This article discusses the manufacture of cane, sorghum, palm, and maple sirups and glucose sirup from starch and from sucrose. Information of special interest in connection with the sugar sirup industry in the Philippines is included.

Kinds of sugar and how made in the Philippine Islands, C. W. HINES (*Philippine Agr. Rev., 11 (1918), No. 4, pp. 248–253, pls. 4*).—A descriptive article.

An improved method of measuring color in the sugar factory, A. E. BAWTREE (*Internatl. Sugar Jour., 22 (1920), No. 262, pp. 556, 557, fig. 1; abs. in Chem. Abs., 15 (1921), No. 2, pp. 323, 324*).—The apparatus employed consists of a long rectangular box, the main part of which is divided lengthwise into two light transmission chambers through which light from a small chamber at one end of the box passes to a corresponding chamber at the other end. One of the light transmission chambers is provided with a calibrated shutter and the other with three transparent glass screens (red, green, and violet), each provided with calibrated shutters. The light from the white light chamber is received on a white glass screen and that from the color element on a similar screen provided with a slot in the center. The apparatus is adjusted by means of the shutters so that light from both chambers is of equal intensity as determined by the disappearance of the slot in the second screen when viewed from an observation slot in the side of the box. On placing in the space between the two screens a transparent receptacle containing the solution to be examined and adjusting the color shutters until the slot in the screen again disappears, the color of the solution may be measured by the percentage readings on the respective color scales.

Advantages claimed for this instrument are a greatly increased accuracy, independence of source of light, and the possibility of analyzing the color into its relative component parts of red, green, and violet, thus indicating what preponderance of color must be removed.

The preservation of bagasse in sugar-cane mill control, G. L. SPENCER (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, p. 1197*).—The author states that ammonia has proved much more satisfactory than formaldehyde as a preservative of samples of bagasse to be used for laboratory analysis. Preliminary experiments have indicated that bagasse or filter press cake may be preserved for several hours in an atmosphere of ammonia and chloroform.

On the settling of precipitates in general and of cane juice precipitates in particular, N. DEERR (*Internatl. Sugar Jour., 22 (1920), No. 263, pp. 618–624, figs. 2*).—This is a study of the rate of settling of the precipitate formed on defecating cane juice from observations of the rate of settling of particles of aluminum hydroxid from suspensions of different concentrations in tall narrow cylindrical vessels, and from similar observations conducted with cane juice to which varying amounts of lime had been added. The conditions in the latter experiment were made to simulate as far as possible factory conditions by using as the cylindrical vessel an ordinary Liebig condenser walled off near the bottom of the inner tube, the inner tube being then filled with the juice previously heated to boiling, and steam at atmospheric pressure allowed to circulate through the outer jacket.

The phenomena observed with cane juices were the same as with suspensions of alumina, i. e., a short period of disturbance followed by a phase of free fall until the critical position occurred, when the line of demarcation between

sediment and clear solution was marked. With the amount of lime furnishing the most satisfactory defecation, representing 1.5 cc. of normal suspension per 100 cc. of juice (0.042 gm. per 100 cc.), the juice was found to settle during the stage of free fall at a uniform rate of 7 cm. per minute. Under these conditions the critical phase would occur at 0.75 h, where h is the height of the settling tank, and the ultimate volume of the mud would be about 15 per cent of the volume of the juice. The initial height of column was found to affect the rate of settling, the higher the column the more rapid the settling.

Recent advances in defecation, W. D. HORNE (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, pp. 1179, 1180*).—A brief description is given of two new clarifiers for sugar defecation, the Dorr clarifier, a development of the Dorr thickener known in metallurgical work, and the Williamson clarifier. The latter is designed to separate all suspended and precipitated material from the sugar solution by flotation with the aid of air bubbles formed by forcing the defecated solution through an aerating vertical pipe into settling tanks heated by transverse steam pipes. Both clarifiers are considered to give promise of greater economy of time, labor, and fuel, as well as a smaller loss of sucrose.

Notes on some decolorizing blacks, C. F. BARDORF (*Canad. Chem. Jour., 4 (1920), No. 8, pp. 207–211*).—This is a general discussion of decolorizing carbons, with reports on the examination and production of Eponite or Norit, and the experimental production and properties of a new carbon "Karbos." This is prepared by digesting 1 kg. of 100-mesh char-dust with 1,250 cc. of commercial HCl for 24 hours, working up the resulting paste with 23 liters of water, adding 70 gm. of charred sawdust, agitating the mixture with an air current or by mechanical means, and filtering as rapidly as possible, after which the residue is washed with two batches of water of 23 liters each. This material is said to be fully as efficient as Norit and to have none of its objectionable features.

Production of "Karbos" decolorizing carbon, C. F. BARDORF (*Internatl. Sugar Jour., 22 (1920), No. 262, pp. 566–569*).—A résumé of the paper noted above.

Continuous filters for using Norit, H. B. VOLLRATH (*Facts About Sugar, 10 (1920), No. 6, pp. 110, 111, fig. 1; abs. in Chem. Abs., 14 (1920), No. 8, pp. 1233, 1234*).—Disadvantages in the use of ordinary filter presses in the recovery of Norit when used as a decolorizing agent in sugar manufacture are discussed, and a new process is described in which the two steps of treating the liquid and recovering the Norit are combined by the use of an automatic continuous filter. This machine is described, and advantages in its use are pointed out.

Contribution to the chemistry of potato starch manufacture, H. TRYLLER (*Chem. Ztg., 44 (1920), Nos. 134, pp. 833, 834; 136, pp. 845–847*).—From ash analyses of crude potato starch and of the starch after washing and treatment with distilled water, natural water, and solutions of different salts, the author concludes that ordinary starch can be considered as the calcium salt of a tribasic starch phosphoric acid with the formula, $(C_6H_{10}O_5)_n(OH)PO\langle{}^{O}_{O}\rangle Ca$. The starch exists in the potato not as a calcium salt, but as an acid potassium salt which is converted into the calcium salt by the calcium contained in the wash water. Part of the calcium is replaceable by magnesium, sodium, iron, and manganese, as can be shown by ash analyses of starch after washing with salts of these metals.

Studies on technical casein (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, pp. 1162–1173, figs. 5*).—This series of papers deals with investigations conducted by the Dairy Division of the U. S. Department of Agriculture for the

purpose of perfecting a process of manufacturing casein to be used in the preparation of waterproof glue for airplanes. The papers are as follows:

I. *Introduction*, W. M. Clark (pp. 1162, 1163).—The author describes briefly the problems involved in preparing a casein of the required specifications and the results actually obtained.

II. *Grain-curd casein*, W. M. Clark, H. F. Zoller, A. O. Dahlberg, and A. C. Weimar (pp. 1163–1167).—This paper describes in detail the technique finally adopted in the manufacture of grain-curd casein, and reports studies of the effect upon the product of washing and of exposure to varying moisture content. The method adopted consisted in the precipitation of the casein with HCl, the chief control being exercised through adjustment of the H-ion concentration to an apparent value of pH=4.6 with methyl red as indicator.

III. *Methods of analysis*, R. H. Shaw (pp. 1168–1171).—Modifications in the tentative methods of casein analysis described from the U. S. Forest Products Laboratory by Browne (E. S. R., 42, p. 111) are reported, with comparative results obtained by the tentative and modified methods. To obtain reliable results in moisture determinations it was found necessary to use the standard method of drying to a constant weight in partial vacuum at the boiling point of water. The best results in ash analysis were obtained by first heating the casein over a very low flame and after it had thoroughly charred completing the ignition at as low a temperature as possible in an electric muffle. For fat the Roese-Gottlieb method gave consistently higher results than those obtained by ether extraction owing, it is thought, to the failure of the ether extraction method to remove all the fat. Sugar was determined by an adaptation of the Official method for determining sugar in cattle feed and phosphorus by the Official method of determining total phosphorus in fertilizers.

A note by W. M. Clark on the free acidity of technical casein is appended.

IV. *Standardization of the borax solubility test for commercial caseins*, H. F. Zoller (pp. 1171–1173).—The borax solubility test, as described in Bulletin 661 of the U. S. Department of Agriculture (E. S. R., 39, p. 386), has been standardized to serve as an accurate means of differentiating caseins according to certain inherent properties depending upon the source and method of separation. The technique of the modified procedure is as follows:

The casein is ground to pass a 40-mesh sieve, 15 gm. is then weighed into a 250 cc. beaker, and 100 cc. of 0.2 *M* borax at 30° C. (76.32 gm. of $Na_2B_4O_7.10H_2O$ diluted to 1 liter) is added with vigorous stirring. The stirring is continued at 5-minute intervals for 30 minutes, although the character of the casein can usually be determined during the first 10 minutes.

Cautions to be observed in performing the test are noted, and a tabulation is given of the relative consistency and physical appearance of different caseins when thus treated. The test is said to differentiate very clearly between high and low temperature caseins. The casein produced by the grain-curd process was found to yield uniform and promising solutions with this modified borax test.

The acid hydrolysis of sugar-cane fiber and cottonseed hulls, E. C. Sherrard and G. W. Blanco (*Jour. Indus. and Engin. Chem., 12 (1920), No. 12, pp. 1160–1162*).—Experiments conducted at the U. S. Forests Products Laboratory, Madison, Wis., on the acid hydrolysis of sugar-cane fiber and cottonseed hulls are reported which show that both materials are unsuitable for the preparation of ethyl alcohol without further treatment, but are very promising sources of xylose and furfural.

Some investigations on prune drying, E. H. Wiegand (*Oregon Sta. Crop Pest and Hort. Rpt. 3 (1915–1920), pp. 52–57, figs. 4*).—As the result of an in-

vestigation of favorable conditions for prune drying, with particular reference to air flow, temperature, and humidity in Oregon-type tunnel driers, the author recommends the use of shallow, 6-in. lug boxes in place of the larger field boxes to facilitate handling the fruit and decrease the amount of spoilage, sorting and grading the fruit before drying, dipping in boiling water or lye to hasten the drying, and maintaining in the drier rapid air movement, uniform temperature, and medium high humidity. The air flow in drying chambers can be increased by having larger air intakes, deep furnace chambers, and shorter stacks with larger cross-section area.

Types of evaporators, W. V. Cruess (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 3, Sup., pp. 105–113, figs. 3*).—This is a discussion of the general principles of evaporation, followed by brief descriptions of evaporators of the natural draft, forced draft, and distillation types.

A brief summary of activities of the U. S. Department of Agriculture in dehydration, P. F. Nichols (*Calif. Dept. Agr. Mo. Bul., 9 (1920), No. 3, Sup., pp. 133–136*).—This is a brief account of the work done during 1919–20 by the division of dehydration of the Bureau of Chemistry, U. S. Department of Agriculture.

METEOROLOGY.

The temperature and precipitation of Alberta, Saskatchewan, and Manitoba, A. J. Connor (*Ottawa: Met. Serv. Canada, 1920, pp. 170, pls. 16, fig. 1*).—This is the second of a series of monographs designed to summarize and analyze eventually all the data of meteorological observations in Canada during the last 70 years or more. The first of these monographs, previously noted (E. S. R., 34, p. 320) dealt with the temperature and precipitation of British Columbia. The data are presented in tables and maps.

To correct an erroneous impression that the provinces with which this monograph deals "are almost altogether a wide expanse of prairie land of nearly unvarying level," it is pointed out that they also contain hilly and broken plateau regions and that the observations so far recorded indicate that "the variability of any of the meteorological factors tends to be least on the open prairie, and greatest where the contours are irregular. Good and bad years from the agricultural standpoint are therefore more likely to be sharply differentiated in southern Saskatchewan and southern Alberta than on the central plains; and this is probably true of the upper portion of the Assiniboine Valley also. . . .

"The fixing of the variability of the rainfall within tabulated limits for various districts is, of course, the most important thing from the agriculturists' viewpoint . . . but on account of the broken character of the records made in these provinces it is at present scarcely possible to fix these variations for any locality. . . . In this present volume it was thought best to give full tables of monthly totals of precipitations from the beginning of observations at each station. These tables give some idea, at least, of the chance or expectation of good rainfall in any of the older districts."

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander and H. W. Poole (*Massachusetts Sta. Met. Buls. 385–386 (1921), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1921, are presented. The data are briefly discussed in general notes on the weather of each month.

Meteorology, H. A. Smith (*N. S. Wales Statis. Register, 1918–19, pt. 6, pp. 297–366*).—Detailed data on pressure, temperature, precipitation, humidity, dew

and fog, and wind at Sydney and other places in New South Wales, 1918–19, as compared with previous years, are summarized.

[Meteorology of Uganda], H. R. WALLIS (*In The Handbook of Uganda. London: Crown Agents for Colonies, 2. ed., 1920, pp. 281–293*).—Detailed meteorological data for 1918 at Entebbe, the capital of the Protectorate, and data for temperature and rainfall only at 52 other places in the Protectorate are summarized in tables. Attention is called to the efforts to extend the meteorological service, particularly in the interest of cotton growing, which is by far the most important industry of the country. The average pressure at Entebbe is slightly over 26.1 in., the mean temperature about 71° F. and very uniform throughout the year, the average annual rainfall for 19 years 58.64 in., and the mean daily sunshine for 15 years 5 hours and 36 minutes.

The control of climate by lakes, E. H. L. SCHWARZ (*Geogr. Jour., 57 (1921), No. 3, pp. 166–181, figs. 2*).—This article deals with the cause and remedy of progressive desiccation of South Africa as discussed in detail in the author's book on the subject, previously noted (E. S. R., 44, p. 208). In the discussion following the reading of the paper, several speakers questioned the practicability of the proposed plan of reclamation.

Phenological observations during 1920, H. BOS (*Cultura, 33 (1921), No. 388, pp. 12–26 fig. 1*).—Observations in different parts of Holland are summarized and discussed. Methods of reporting results of phenological observations are also briefly considered.

Nitrogen in the rainwater at Ithaca, N. Y., B. D. WILSON (*Soil Sci., 11 (1921), No. 2, pp. 101–110, fig. 1*).—Studies conducted at Cornell University on the amounts of ammoniacal and nitrate nitrogen added to the soil by rain showed that with an average annual rainfall of 29.31 in, between May 1, 1915, and May 1, 1920, the soil received annually 12.51 lbs. of nitrogen to the acre. Of this amount 11.5 lbs. was in the form of ammoniacal nitrogen and 1.01 lbs. in the form of nitrate nitrogen. The ammoniacal nitrogen fluctuated from month to month and from year to year, while the nitrate nitrogen remained more constant. The amount of total nitrogen in the rainwater was to a large extent dependent upon the amount of rainfall, a high nitrogen content accompanying a correspondingly high precipitation.

The rainfall during the spring and summer months contained more nitrogen than that falling during the other two seasons. The ammoniacal nitrogen decreased rather suddenly during August and continued low during September and October in spite of heavy rainfalls. This decrease is considered to be probably due to the atmosphere being washed comparatively free of ammonia by previous rains. Electrical discharges did not increase the nitrate nitrogen content of the rainwater to any considerable extent.

The amount of ammoniacal nitrogen brought down in the rain falling at Ithaca, N. Y., is said to be somewhat larger than that reported from many parts of the world, while the nitrate nitrogen content is about the same.

A bibliography of 12 references to the literature of the subject is given.

Experiments with smudge to protect plants against night frosts, VAN DER LINDEN, J. G. HAZELOOP, and N. VAN POETEREN (*Verslag. Meded. Phytopath. Dienst Wageningen, No. 15 (1920), pp. 24, pls. 4, fig. 1*).—Tests of various smudge materials and of different methods of using them for the protection of potatoes, strawberries, begonias, and similar plants are reported.

Especially good results were obtained with peat saturated with crude naphthalin. The beneficial effects are ascribed both to direct heating of the air and to prevention of radiation by the smudge produced. For small areas, burning the smudge materials along the windward side was found to be sufficient.

SOILS—FERTILIZERS.

Soil survey of Madison County, Ga., D. D. Long (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 32, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 181,760 acres in northeastern Georgia. The area is a part of the Piedmont Plateau, and ranges in topography from gently undulating through gently rolling to hilly. The drainage of the entire county is said to be well established.

The soils are largely of residual and alluvial origin. Including meadow, 11 soil types of 6 series are mapped, of which the Cecil sandy loam and sandy clay loam and the Madison gravelly sandy clay loam and gravelly sandy loam cover 30, 24.4, 15.4, and 12.7 per cent of the area, respectively.

Deep cultivation of soil, A. Taillefert (*La Culture Profonde du Sol. Cernier [Switzerland]: Soc. Printers, 1920, 2. ed., pp. 59, figs. 8*).—This publication, dealing with the deep cultivation of Swiss soils, enumerates the principal advantages of such cultivation, describes methods and machinery therefor, and reports three years of tests of the influence of deep cultivation on the growth and yield of different crops, including potatoes, beets, turnips, carrots, and cereals.

It was found that the yield of most of the crops increased rather uniformly with the depth of cultivation, especially when it was accomplished by trenching and subsoiling, which prevented the raw subsoil from coming to the surface. This was true to a depth as great as 34 cm. (13.4 in.) on both fertilized and unfertilized soils. Potatoes and turnips were found to respond more readily to the good effects of deep cultivation than the other crops, although in certain soils beets and carrots responded markedly. Cereal crops did not respond so readily to deep cultivation, especially where subsoiling was recent.

The soil and the soil solution, O. Nolte (*Jour. Landw., 65 (1917), pp. 1–66, figs. 2*).—In a contribution from the University of Göttingen, a theoretical discussion of the soil and the soil solution on the basis of the law of chemical mass action is given, resulting in the conclusion that the disruption of the chemical equilibrium in soil under the influence of climate, vegetation, animals, and man is of considerable importance. The effect of sea water on soils, the formation of cracks and impervious strata in marsh soils, alkali soils, the influence of fertilizers on soil reaction, and the reaction of soils in general are discussed, among other things, as results of the upsetting of chemical equilibrium in soil.

The concentration of the soil solution around the soil particles, G. J. Bouyoucos (*Soil Sci., 11 (1921), No. 2, pp. 131–138*).—Studies conducted at the Michigan Experiment Station are reported which showed that contrary to the general opinion, the solution around the soil particles and in the very fine capillary spaces is less concentrated than the mass of the solution.

The action of frost on the soil, O. Nolte and E. Hahn (*Jour. Landw., 65 (1917), pp. 75–81, figs. 4*).—Studies conducted at the University of Göttingen on the mechanical, physical, and chemical influence of freezing in soils are reported.

It was found that in many soils an increase of almost 10 per cent in volume was caused by freezing. While freezing had a loosening effect on the soil, this effect decreased rapidly after thawing since the void spaces filled with water and caused puddling. Observations on the freezing of suspensions of fine particles as they exist in the soil showed that freezing caused stratification and grouping of the particles. With reference to the action of frost on the size of soil grains, it was found that the most marked breaking up of soil grains

took place in soils poor in fine particles, while in soils rich in colloids there was a decrease in soil surface.

The forms of acidity in soil and their plant physiological importance, H. KAPPEN (*Landw. Vers. Sta., 96 (1920), No. 5–6, pp. 277–307, fig. 1*).—A number of studies are summarized to show that there are three definite forms of acidity in soils, which are called free or active acidity, exchange acidity, and hydrolytic acidity.

The free or active acidity is that which can be washed out of the soil with water and detected in the resulting solution. This active acidity was never found in mineral soils, but usually in acid humus soils. The so-called exchange acidity is that indicated when soils are treated with solutions of neutral salts and the solution becomes acid. Such acidity was found not only in acid humus soils but also in acid mineral soils. It is not considered particularly injurious to plant growth. The so-called hydrolytic acidity is that indicated by soils which are able to break up salts composed of strong bases and weak acids, absorb the bases, and set the weak acids free. This type of soil acidity is considered to have no bearing whatever on the growth of plants and was found in mineral soils free from humus.

It is the opinion that the so-called humus acids, which are not classified, are closely related to the hydrolytic acids in that they do not injure plants. It is pointed out in this connection that the free strong inorganic acids and not the weak organic acids injure plants, especially in moor soils. It is concluded that the liming of upland moor soils results first of all in the neutralizing of the free active acids, after which the exchange acids and hydrolytic and humus acids are neutralized in turn, the two last being the least affected.

Some aspects of bacteriological activity in Egyptian soils, J. A. PRESCOTT (*Sultan. Agr. Soc., Tech. Sect., Bul. 2 (1920), pp. [2]+47*).—The results of four years of study, conducted to follow the intensity of the bacteriological processes in the soil of an Egyptian farm during the most important periods of the Egyptian farming rotation, are reported. Part of these results has been previously noted (E. S. R., 41, p. 812). The fluctuation in the nitrate content of the soil was taken as the most important index of this activity.

The sheraqui soils of the summer fallow were found to be biologically dormant. They are characterized by a very low moisture content and fairly high temperatures. Experiments showed that these conditions produce a partial sterilization of the soil. During the Nile flood the basin soils were found to be characterized by low bacteriological activity with complete suppression of nitrification and the accumulation of ammonia. After the flood nitrification begins immediately and the ammonia disappears.

The results of field experiments are appended, illustrating the relationship of the movements of soil nitrates to the problems of manuring and cultivation of the maize crop. Sodium nitrate was added before and during the period of growth, the maximum yield being obtained when added during the period of growth. Determination of the nitrate content of the soil and subsoil in October showed its presence in fairly large amounts. The soils receiving sodium nitrate before sowing contained the most nitrate. These results are taken to indicate that some of the nitrate at least was out of the reach of the plant roots, chiefly on the tops of the ridges, as a result of capillary movement. It is considered evident that the system of cultivation on ridges had a special effect on the utilization of nitrogenous fertilizers.

Further experiments covering two years showed that if the maize is grown on flat ground, or if the ridges are destroyed during the active period of growth, the time of application of sodium nitrate makes no difference in the final yield.

Experiments on natural nitrification in soils, based on studies of drainage waters in 1906 and 1907, E. NORIEGA (*Rev. Agr. [Colombia], 5 (1919), No. 9–12, pp. 525–560*).—Studies conducted in Colombia, South America, of the nitrogen supplies of barren soils and soils cropped to cereals and legumes, as indicated by analyses of the drainage waters under different conditions, are reported.

It was found that clay soils are retentive of moisture and have a tendency also to retain and mobilize relatively large quantities of organic nitrogen, especially during growing periods with low rainfall. Under such circumstances the nitrogen losses in drainage waters are small in winter and spring and amount to practically nothing during the summer, since most of the nitrogen accumulated is utilized by crops. In wet seasons the losses of nitrogen in drainage waters were large, and small in dry seasons.

Cultivation and cropping reduced nitrogen losses in the drainage water, which is attributed both to the utilization of the nitrogen by the crops and the more favorable conditions for nitrification. Cereal crops utilized more soil nitrogen in their growth than legumes, and consequently there was less loss of nitrogen in the drainage water from cereal cropped soils than from legume cropped soils.

Preliminary studies on ammonification and nitrification in Porto Rico soils, C. E. CHARDÓN PALACIOS (*Rev. Agr. Puerto Rico, 5 (1921), No. 7, pp. 37–46, figs. 4*).—Ammonification and nitrification studies of acid clay soils of Porto Rico, typical of the soils around Mayaguez, are reported.

The studies were conducted with soil alone and treated with lime, dried blood, and lime and dried blood together. Where dried blood was not used, the ammonia content of limed soils increased rapidly during the first 13 days and then decreased. The content of nitrates was more or less uniform for the first 13 days and then increased rapidly. Liming increased the nitrate content of these soils 28.6 per cent. Ammonification and nitrification proceeded in much the same manner in the soils treated with dried blood. Where lime was also used the amount of nitrates present was 29.6 per cent greater after 38 days than where dried blood was added alone. It is concluded that lime should be applied to acid clay soils whether they are treated with organic nitrogenous fertilizers or not

Peat as a source of energy for nitrogen-assimilating bacteria, E. W. SCHMIDT (*Centbl. Bakt. [etc.], 2. Abt., 52 (1920), No. 13–15, pp. 281–289*).—Experiments are reported which showed that the cellular membrane of new sphagnum moss and young sphagnum peat is attacked by cellulose bacteria, resulting in a by-product which serves as a nutritive medium for Azotobacter. It is concluded that these materials can serve as an indirect source of carbohydrates similar to filter paper for Azotobacter. The peat moss membrane was found to be relatively slowly attacked by the cellulose bacteria, but this resistance was decreased by preliminary treatment by boiling, steaming, or pulverizing. When peat was treated with dilute hydrochloric acid a product was obtained after neutralization which, it is thought, gave optimum living conditions for Azotobacter.

Further studies are considered necessary to establish methods for the practical use of these findings in the treatment of soil.

The carbon dioxid nutrition of plants, O. LEMMERMANN (*Mitt. Deut. Landw. Gesell., 35 (1920), No. 51, pp. 696–699*).—Continuing studies previously noted (E. S. R., 26, p. 321), laboratory and field experiments with stable and green manures are reported, in which no confirmation was obtained of the

theory advanced by others that the carbon dioxid produced by the decomposition of organic matter in soils is of essential importance for the carbon dioxid nutrition of crops.

Soil fertility, M. M. McCool, C. E. Millar, and G. M. Grantham (*Michigan Sta. Bul. 290 (1920), pp. 39, figs. 15*).—A popular version of the summarized results of work by the station on the maintenance of the fertility of Michigan soils is presented in this bulletin. While dealing primarily with the use of fertilizers and the maintenance of a sufficient and well balanced amount of nutrient material in the soil, it also takes up the prevention of soil erosion, the use of soil amendments, such as lime and organic matter, and draws special attention to the importance of maintaining the nitrogen supply by the growing and plowing under of leguminous crops.

Soil fertility investigations (*Oregon Sta. Rpt. 1919–20, pp. 34–36*).—The general progress results of soil fertility investigations, including rotations and fertilizer experiments, are briefly noted. The most striking feature is the fact that sulphur was found to be the limiting element in certain soils growing legumes.

Fertilizer experiments in Texas, G. S. Fraps (*Amer. Fert., 54 (1921), No. 4, pp. 51–53*).—In a contribution from the Texas Experiment Station, the limitations of chemical analysis in determining the fertilizer requirements of soils are pointed out, and attention is drawn to the proper conduct of fertility experiments. The results of some 289 cooperative fertilizer experiments conducted at the station are briefly summarized, indicating that phosphoric acid and nitrogen are the materials limiting the fertility of Texas soils.

Field fertilization experiments, M. Schmoeger (*Arb. Deut. Landw. Gesell., No. 304 (1920), pp. 103*).—A large number of field fertilizer experiments extending from 1903 to 1917 and conducted in different localities of Prussia by the Danzig Experiment Station are reported.

Special attention was given to comparisons of sodium nitrate and ammonium sulphate in applications of varying sizes, with and without lime, and to the comparative values of lime nitrogen and urea as sources of nitrogen. Comparative studies of different sources of lime, phosphoric acid, and potash were also conducted. The crops were oats, rye, barley, wheat, sugar beets, potatoes, and clover.

The results of each individual test are given in detail, but no general conclusions are drawn. The data indicate that sodium nitrate gave the best results as a nitrogenous fertilizer for most crops. Most of the crops were increased by the use of nitrogenous fertilizers, except clover, which was apparently injured by ammonium sulphate and lime nitrogen.

Plant analysis and fertilization, F. Münter (*Jour. Landw., 68 (1920), No. 3, pp. 207–224*).—In a continuation of work previously reported (E. S. R., 43, p. 518) it was found that on loess loam soil nitrogen and phosphoric acid fertilization decreased the silica content of barley straw, while nitrogen, potash, and phosphoric acid fertilization did not markedly influence the lime and magnesia content of barley. The weather conditions of a single year exercised so strong an influence on the growth of barley that the percentage contents of the crop in nitrogen, potash, and phosphoric acid could not be taken as sure indications of the fertilizer requirements of the soil. The nitrogen content of barley straw was slightly decreased by potash and strongly decreased by phosphoric acid fertilization. These results are taken to indicate that barley is unsuitable for experiments to indicate the fertilizer requirements of soils.

The production of beet roots was found to be influenced in favorable years by nitrogen and in unfavorable years by phosphoric acid, but never more than

slightly by potash fertilization. Beet-leaf production depended upon nitrogen fertilization. Fertilization did not materially influence the lime and magnesia contents of beet roots. On the other hand, potash fertilization increased the lime and magnesia contents of beet leaves and phosphoric-acid fertilization decreased them. It is the opinion that the beet leaves from 1 hectare (2.47 acres) should contain 50 kg. (110 lbs.) of nitrogen, or that the leaves and roots together should contain 100 kg. of nitrogen, otherwise there is a nitrogen deficiency in the soil. Also, if the beet roots from 1 hectare contain less than 14 kg. of phosphoric acid, there is a phosphoric-acid deficiency in the soil.

The weather conditions were found to exercise so strong an influence upon the growth of beets that the nitrogen and potash contents expressed as percentages gave no indications of the fertilizer requirements of the soil. For phosphoric acid minimum percentages of 0.18 in the roots and 0.4 in the leaves were established.

It is the opinion that, to best determine the fertilizer requirements of a soil, one set of plats should be fertilized with nitrogen and another with potash and phosphoric acid. The soil is considered to be deficient in potash if the percentage content of potash in the beet leaves from the nitrogen-treated plats is less than the percentage nitrogen content. Similarly, the soil is considered to be deficient in phosphoric acid if the ratio of nitrogen to phosphoric acid in the beet leaves from the nitrogen-treated plats is greater than 5:1. If the ratio is less than 20:7 on the potash and phosphoric-acid treated plats, the soil is deficient in nitrogen. Apparently the conclusion is also drawn that if the potash and phosphoric acid from the nitrogen-treated plats are less than 60 and 40 per cent, respectively, of the potash and phosphoric acid from the phosphoric acid and potash-treated plats, the soil is deficient in these materials.

The conservation, fertilizing value, and use of liquid manure, GERLACH (*Landw. Jahrb., 53 (1919), pp. 77–107*).—Conservation and fertilization experiments with urine used with peat litter, straw chaff, humus brown coal, superphosphate, formalin, gypsum, gypsum superphosphate, and potash salts are reported, together with the results of observations on the fermentation of urea when the conserving media were added.

It was found that straw chaff and peat litter retarded nitrogen losses, but did not prevent them. Humus brown coal when added at the rate of 60 per cent practically prevented nitrogen losses. Superphosphate was active in nitrogen conservation, as was also formalin when added at the rate of 0.5 per cent. Gypsum and gypsum superphosphate were also active in this respect, although the former did not fully prevent nitrogen losses and the latter only when added at the rate of 10 per cent. Raw potash salts were effective and profitable conserving media, but they did not fully prevent nitrogen losses. All the materials used retarded the fermentation of urea, but did not prevent it. The liquid manure treated with conserving media gave good results as a source of nitrogen.

The cause of nitrogen losses from liquid and stable manure, O. NOLTE (*Landw. Vers. Sta., 96 (1920), No. 5–6, pp. 309–324, fig. 1*).—A number of experiments conducted at the Rostock Experiment Station are reported, from which the conclusion is drawn that the cause of nitrogen losses from liquid manure is the volatility of the ammonia content, which is related closely to the carbon dioxid evaporation. The ratio of nitrogen to carbon dioxid escaping was found to be about 0.75. Moisture evaporation is considered to have no influence on the escape of nitrogen. The speed of evaporation is considered to be governed by the relative tension of ammonia and carbon dioxid in the urine.

Studies of the relative values of different conserving materials showed that the alkaline chlorids and sulphates have no conserving action, since they do not generally decrease the concentration of carbon dioxid. On the other hand, the chlorids of soil alkalis, such as magnesium, barium, and calcium chlorids were able to prevent nitrogen losses in accordance with their basicity and the stability of the carbonates formed. Gypsum also gave good results when added in amounts equivalent by weight to the ammonium carbonate present, but, unlike the chlorids of soil alkalis, its conserving action did not increase when double or triple this amount was added. Sulphuric acid in additions equivalent by weight to the ammonium carbonate present was capable of preventing nitrogen losses completely. Phosphoric acid and different calcium phosphates were also active in preventing nitrogen losses when added in proper amounts. The action of a so-called humus carbon was also found to be good owing to its power to absorb gaseous ammonia.

Can the action of lime nitrogen be improved? M. Popp (*Deut. Landw. Presse, 47 (1920), No. 90, pp. 617, 618*).—Experiments on the influence of carbolineum and so-called humus carbolineum on the fertilizing action of lime nitrogen when applied to oats, potatoes, and vegetable crops on different soils are reported.

It was found that these two disinfectants increased the action of lime nitrogen in most cases, especially the humus carbolineum. It is concluded that the action of lime nitrogen can be increased by the use of such disinfectants in proper form.

Fertilizer experiments with ammonium chlorid, C. von Seelhorst and H. Voigt (*Jour. Landw., 64 (1916), No. 1–2, pp. 23–30, pl. 1*).—From box, cylinder, and pot experiments with barley, oats, beets, and potatoes it is concluded that ammonium chlorid is as good a nitrogenous fertilizer as ammonium sulphate and almost as good as sodium nitrate.

Potash fertilizer experiments, C. von Seelhorst and H. Voigt (*Jour. Landw., 64 (1916) No. 1–2, pp. 31–36, pls. 3*).—Experiments with different crops to study the action of kainit and 40-per-cent potash salts showed that garden beans and red clover were badly injured by heavy fertilization with kainit. The injury was evident on both the roots and the above-ground part of the plants. On the other hand, horse beans were not injured by the heaviest kainit applications. When the soil in pots was well drained the garden beans and red clover were as little injured by kainit as horse beans. There was marked nodule formation on the roots of garden beans in drained soil treated with kainit, but not in undrained soil similarly treated. This difference was not so marked with red clover, and horse-bean roots produced nodules in kainit-treated soil whether drained or undrained. The 40-per-cent potash salts apparently gave good results with most crops in both small and large applications.

Some effects of potassium salts on soils, R. S. Smith (*New York Cornell Sta. Mem. 35 (1920), pp. 571–605, figs. 3*).—A review is given of the work of others bearing on the subject, and studies to determine the effect of various applications of potassium chlorid and sulphate on the growth of wheat in Hagerstown, Dekalb, and Volusia silt loam soils and in their water extracts are reported. The productivity of the soils studied ranged from high to very low.

Potassium sulphate increased the yield of straw in Hagerstown soil and showed no toxic effect in Dekalb soil. Potassium chlorid apparently became toxic to wheat in Hagerstown soil with the 1,000-lb. application, and in the Dekalb soil there was a slight decrease in yield with the 2,000-lb. treatment.

In the extracts from the Hagerstown soil, potassium chlorid stimulated the root growth of wheat seedlings at all concentrations, the greatest stimulation

occurring with the 500-lb. treatment. With the sulphate there was a progressive stimulation to the 2,000-lb. treatment and a marked toxicity with the 3,000-lb. treatment. In the extracts from the Dekalb soil, the checks were toxic to the root growth of wheat seedlings. With the chlorid the 200-lb. treatment caused the greatest stimulation, and there was a decrease in stimulation and apparent toxicity with the heavier treatments. With the sulphate the 500-lb. treatment caused the greatest stimulation, and there was a decrease in stimulation and apparent toxicity with the heavier treatments. In the extracts from the no-lime series of the Volusia soil, toxicity to root growth became evident with the 500-lb. treatment. Lime overcame the toxicity even with the heaviest chlorid treatment.

Potassium chlorid decreased the accumulation of nitrates in all cases, but lime overcame this effect in part. Potassium sulphate apparently stimulated the accumulation of nitrates in Hagerstown and Dekalb soils. The heavier potassium chlorid treatments depressed nitrification of added materials. Potassium sulphate stimulated the process in all three soils with the exception of the heaviest treatment with Hagerstown soil. Lime had a tendency to correct the depression of the chlorid in the Volusia soil, but did not entirely overcome it.

"No iron nor aluminum was found in any of the water extracts, and no manganese was found in the extracts from the Volusia soil; hence the harmful action of the potassium salts can not be attributed to replaced iron or aluminum, or to manganese in the case of Volusia soil. Both the chlorid and the sulphate of potassium replaced calcium strongly. Less calcium appeared in the extract from the sulphate-treated series than would be expected, possibly because of the relative insolubility of calcium sulphate. Magnesium was replaced less strongly than was calcium. Manganese was replaced in very appreciable amounts in Hagerstown and Dekalb soil, particularly in the latter. The soil highest in water-soluble manganese showed the least nitrifying efficiency, the smallest growth of wheat in pot cultures, and the poorest growth of wheat rootlets in extract cultures. The effects of potassium salts on plant growth are due to a complex interaction of factors, involving, perhaps, the direct action of the salts on plant growth and on bacterial activities, and also the action of bases replaced by the potassium, particularly manganese."

Gypsum as a fertilizer, O. Nolte (*Jour. Landw., 65 (1917), pp. 67–73*).—A review of the work of others extending over several years on the action of gypsum as a fertilizer is given, leading to the conclusion that both the calcium and the sulphate of gypsum are active in soils and that it has a tendency to transform soil minerals. As a result of its tendency to break up into an acid and base, gypsum should never be used on acid soils nor in conjunction with acid or physiologically acid fertilizers. It may be used with physiologically basic salts, however, as in such cases it promotes a loose soil structure and improves soil ventilation.

Sulphur as a fertilizer (*Oregon Sta. Rpt. 1919–20, p. 39*).—The use of sulphate sulphur with nitrate nitrogen in controlled cultures of soils and sand outdoors and in the greenhouse resulted in the formation of larger amounts of true protein in clover than was the case with clover grown under field conditions with and without sulphate.

In soil that was first sterilized, then inoculated with legume bacteria, limed, and fertilized with sodium sulphate or calcium sulphate, the influence of sulphur was not noticeable in the formation of larger amounts of either true protein or of total nitrogen, evidently because of the much slower growth. The inference is that a sulphur fertilizer would be most potent in increasing protein formation in legumes under conditions that make for rapid growth.

Contribution to the explanation of the "manganese question," P. Ehrenberg and K. Schultze (*Jour. Landw., 64 (1916), No. 1–2, pp. 37–129*).—A review of the work of others bearing on the subject is given, and several years' studies are reported which showed that no stimulating action of manganese compounds on crops could be detected. Crops were apparently neither increased nor decreased by manganese. There were some indications that manganese under certain favorable conditions acted to increase the available nitrogen supply by an exchange of bases. There was also a considerable increase in concentration of the soil solution by especially large applications of manganese. It is concluded that its general use as a stimulant can not yet be recommended.

The action of lead as a stimulant for plants, A. Stutzer (*Jour. Landw., 64 (1916), No. 1–2, pp. 1–8, pl. 1*).—Water culture and field experiments with different crops to determine the action of lead nitrate showed that it does act as a stimulant to crops. Lead nitrate did not remain long in the soil as such but was soon transformed into the insoluble sulphate and carbonate forms. The lead was not entirely inactive in these forms, as it was in very finely divided condition. The practical difficulty in the use of such stimulants as lead lies in the extremely small quantities which must be used, requiring the perfection and use of special apparatus by fertilizer manufacturers in the intimate mixing of the small quantities of lead with potash or other fertilizer salts.

Testing fertilizers for Missouri farmers, 1920 (*Missouri Sta. Bul. 178 (1921), pp. 72, fig. 1*).—This bulletin contains an introductory statement by F. B. Mumford, an article on How to Use Commercial Fertilizers, by M. F. Miller, giving practical information based on the results of work by the station, and the report of the station chemist, by L. D. Haigh, on fertilizer inspection in Missouri during 1920.

The fertilizer report contains a list of brands of fertilizers and fertilizer materials, with their guarantied analyses, registered for sale in the State during 1920, the results of analyses and valuations of 499 samples, representing 191 brands of fertilizers and fertilizer materials, collected for inspection in the State during 1920, and the results of tests of the neutralizing action of 397 samples of agricultural limestones on soil acidity.

AGRICULTURAL BOTANY.

Hereditary fasciation, L. Blaringhem (*Compt. Rend. Acad. Sci. [Paris], 169 (1919), No. 6, pp. 298–300*).—Study of successive generations derived from an individual plant considered as introducing a new species, named *Capsella viguieri*, has confirmed the stability of an important character, that of stem fasciation. This is compared as to its constancy with a similar character in *Celosia cristata*.

Further Epilobium crossings, E. Lehmann (*Ber. Deut. Bot. Gesell., 37 (1919), No. 8, pp. 347–357, figs. 6*).—A descriptive account is given of results of studies on crosses of *Epilobium* spp., extending those previously reported (E. S. R., 42, p. 128).

Vegetative vigor and sterility in hybrids between species of Digitalis, L. Blaringhem (*Compt. Rend. Acad. Sci. [Paris], 169 (1919), No. 10, pp. 481–483*).—It is stated that hybridization between *D. purpurea* and *D. lutea*, while involving sterility, causes excessive development of vegetative tissues which show the characters appropriate to young plants.

Experimental production and orientation of sexuality in fungi, Bezssonoff (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 5, pp. 288–290*).—Studies are briefly cited which are said to show that microphotography makes

very clear the differences between the aspect of mycelium growing in ordinary and that in special cultures. Observations cited are considered to show that the presence of sugar in strong concentrations in the nutritive medium conditions the development of a mycelium very rich in granular mitochondria, favoring also the development of sexual organs.

Parthenocarpy in apple, A. Manaresi and G. Romagnoli (*Coltivatore, 66 (1920), No 22, pp. 521–525, figs. 5*).—The methods and results are given, with discussion, of preventing fertilization in several apple varieties which are named.

Antagonistic reactions and the rôle of the callus in grafted plants, L. Daniel (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 5, pp. 285–287*).—The author concludes from the facts here presented that the callus in grafted plants contributes considerably to modify the biological condition of both stock and graft and to develop a clearly marked antagonism determining the formation of reparative organs, which are briefly discussed.

A new genus of Leguminosæ, C. V. Piper (*Jour. Wash. Acad. Sci., 10 (1920), No. 15, pp. 432, 433*).—Among specimens of Leguminosæ referred to Canavalia in the U. S. National Herbarium, one, appearing to be more clearly related in floral characters with Dolichos, was placed in a new genus erected for that purpose. To this form the name *Monoplegma sphærospermum* was given.

Occurrence of a new species of Asphodelus under the action of marine climate, L. Daniel (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 22, pp. 1332, 1333*).—Results of an experimental seeding once repeated indicated the production of a new Asphodelus, which has been named *A. luteoides*.

The habitats of the halophytes.—III, IV, R. Kolkwitz (*Ber. Deut. Bot. Gesell., 37 (1919), Nos. 8, pp. 343–347; 9, pp. 420–426*).—These articles continue the series previously noted (E. S. R., 42, p. 628) dealing, respectively, with *Triglochin maritima* and *Erythræa linariifolia*.

[A study of roots], M. Plaut (In *Festschrift zur Feier des 100 Jährigen Bestehens der Kgl. Württ. Landwirtschaftlichen Hochschule Hohenheim. Stuttgart: Eugen Ulmer, 1918, pp. 129–151, figs. 8*).—Roots are dealt with as to their anatomy, relations, changes (periodicity), and the distribution of certain characters among pteridophytes, gymnosperms, monocotyledons, and dicotyledons.

Resistance of the roots of some fruit species to low temperature, D. B. Carrick (*New York Cornell Sta. Mem. 36 (1920), pp. 613–661, pls. 2, fig. 1*).—On account of the injury frequently done to the roots of fruit trees and bushes by freezing and the possible bearing resistance to cold may have on uses of stocks, the author conducted a series of experiments in which roots of various species and varieties were subjected to artificial temperatures from —7 to—20.5° C. The temperatures were reduced gradually and held at the minimum for 15 minutes, after which the pieces of roots were rather rapidly thawed out. An inspection of the roots for injury was usually made within from one to three days after exposure. At first microtome sections were prepared and the character of the injury determined with a low-power microscope, but this was soon found unnecessary since the color changes of the frozen cells, with the exception of the gooseberry and currant, were rather striking. The state of maturity and the diameter of the roots were found to be the most important factors in determining the resistance to freezing of all species tested.

There was found to be little difference in hardiness of the roots between American and French apple seedlings. French pear stock appeared more tender than Kieffer stock, and the roots of both were less resistant to freezing than the apple. Peach roots on which the variety Elberta had been budded were found about equal in resistance to the Kieffer pear. Of four cherry stocks

tested, the order of hardiness was Mahaleb, *Prunus besseyi*, *P. pennsylvanicum*, and Mazzard, the Mahaleb stock being considerably more resistant than the apple, while the Mazzard was about equal to that of the French pear. Myrobalan plums were in about the same category as French pears and Mazzard cherries.

Of six varieties of grapes studied, the roots of the Clinton and the Concord were the hardiest, being about equal to the Mahaleb cherry. No significant differences were seen between the hardiness of blackberry and red raspberry roots. The roots of the Downing gooseberry were found more resistant than those of the Wilder currant. Gooseberry and currant roots in general appeared hardier than any other roots examined.

The freezing-point depression of the Wilder currant sap was found greater than that of the apple sap, and sap from the upper half of American-grown apple roots was of a higher concentration than that from the lower half of the same roots. The upper half of the roots was also more resistant to cold.

A rapid fall in temperature was found to increase the freezing injury in apple roots, and in nearly all cases in which the material was allowed to dry, its resistance was increased. The difference in the response to cold of the moist tissue and the dry tissue is thought to be due to the smaller ice masses formed in the dry root. It is suggested further that causes other than dehydration must be considered as contributing to the phenomenon of freezing of the plant tissue.

The December freeze—some lessons from it, W. S. Brown (*Oregon Sta. Crop Pest and Hort. Rpt. 3 (1915–1920), pp. 9–14, figs. 4*).—The author describes the injury done orchard trees and small fruit plants by the severe weather of December, 1919, when the temperature fell 15 to 20° below any previously recorded minimum. Suggestions are given for repairing the damage as much as possible by pruning, fertilizing, etc. To avoid damage by severe cold, the author recommends the adoption of methods of orchard management that will produce well-ripened wood before winter sets in.

Germination capacity and tendency in seeds, particularly cereals, G. Lakon (In *Festschrift zur Feier des 100 Jährigen Bestehens der Kgl. Württ. Landwirtschaftlichen Hochschule Hohenheim. Stuttgart: Eugen Ulmer, 1918, pp. 70–83*).—This is an attempt to attain high germination percentages by seed management or treatment, as well as greater precision in the use of terms commonly used in this connection.

Specific assimilation energy, H. Fischer (*Ber. Deut. Bot. Gesell., 37 (1919), No. 7, pp. 280–285*).—This is mainly a discussion of recent contributions bearing upon the phenomena grouped in relation to specific assimilation in plants.

The symbiotic complex of the cell, F. Ladreyt (*Compt. Rend. Acad. Sci. [Paris], 169 (1919), No. 15, pp. 665–667*).—Studies by the author regarding the evolution, character, and behavior of the chondriomes in their relations led up to the statement that the cell appears to be a symbiotic complex in which a harmonious association exists among the members, as cytoplasm, chondriome, and nucleus, which is advantageous to the members severally.

The biochemistry and physiology of the cell wall and of the plasmatic membranes, B. Hansteen-Cranner (*Ber. Deut. Bot. Gesell., 37 (1919), No. 8, pp. 380–391, pls. 2*).—This preliminary study is thought to indicate that the plasmatic bounding layers of the cell body present the aspect of a lipoid-colloid system, consisting (as to its semifluid dispersion medium) of lipoid insoluble in water and swelling in colloids, but soluble as to its disperse phase in water-soluble lipoids. These bounding layers with all their lipoids are present in all the cell walls and blend intimately therewith. Owing to this fact the walls of all living cells present a colloidal network, the framework of which is formed

of cellulose and hemicellulose, the finer portions of lipoids. It is deemed probable that the greater part of the living substance consists of very freely reacting lipoids and not of proteid materials.

Progressive changes in the permeability of plasma to salt solutions, K. Höfler (*Ber. Deut. Bot. Gesell.*, *37* (*1919*), *No. 8, pp. 314–326*).—A study of plasmolytic behavior in cells of *Tradescantia elongata* in potassium nitrate solution is described as showing alterations in permeability under the conditions indicated, also different behavior in neighboring cells. A general augmentation of permeability occurred previous to the death of the cells.

Determination of permeability by the method of plasmolysis, K. Höfler (*Ber. Deut. Bot. Gesell.*, *36* (*1918*), *No. 7, pp. 414–422, fig. 1*).—The increase of plasmolysis during a period of time is utilized to determine protoplasmic permeability.

[The measurement of permeability], K. Höfler (*Ber. Deut. Bot. Gesell.*, *36* (*1918*), *No. 7, pp. 423–442, fig. 1*).—The permeability of *Tradescantia elongata* for potassium nitrate was measured by the method noted above and was found to differ surprisingly for neighboring cells under like conditions, as indicated by numerical data presented.

The chondriome and ergastoplasmic formations of the embryonic sac in Liliaceæ, A. Guilliermond (*Compt. Rend. Acad. Sci.* [*Paris*], *169* (*1919*), *No. 6, pp. 300–303, figs. 4*).—Studies on *Lilium candidum* and *L. croceum*, employing the method of Regaud as available throughout the whole evolution of the chandriome, permit presentation in considerable detail of apparent structures and changes.

The resolution of the so-called chondriome into vacuome, plastidome, and spherome, P. A. Dangeard (*Compt. Rend. Acad. Sci.* [*Paris*], *169* (*1919*), *No. 22, pp. 1005–1010, figs. 3*).—The author attempts to remedy the prevalent confusion regarding the views taken of the nature and rôle of the cytological elements designated as chondriomes and mitochondria. He has followed up his former study (E. S. R., 40, p. 223) with an investigation of very young barley plantlets, and characterizes three classes of bodies claimed to be clearly distinguishable as vacuome, plastidome, and spherome. These are precisely described according to the author's differentiation in connection with different names which they or bodies supposedly identical with them have received.

The vacuome, of which the metachromes stain differentially, contains metachromatin which may condense into metachromatic corpuscles and grains of aleurone, accumulate lipoids, and furnish anthocyan. The plastidome is constituted of mitoplasts, amyloplasts, chloroplasts, and chromoplasts, which elaborate starch and pigments chlorophyllous and carotinoid in character. The spherome is constituted of microsomes impregnated with oleaginous substances.

Plastidome, vacuome, and spherome in Selaginella kraussiana, P. A. Dangeard (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 6, pp. 301–306, figs. 10*).—The author has confirmed the conclusions noted above by a study of such other cereals as wheat, rye, and maize, and has extended these studies to include a vascular cryptogam, *S. kraussiana*. This also has been found to contain the three cellular elements referred to.

Evolution of a vacuolar system in Gymnosperms, P. Dangeard (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 8, pp. 474–477, figs. 8*).—The study here outlined, dealing with various portions of *Larix europea*, *Taxus baccata*, and *Gingko biloba* gives results comparable to those noted above as regards demonstration of the three systems in the cytoplasm.

The evolution of the chondriome in plant cells, A. Guilliermond (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 3, pp. 194–197, figs. 4*).—This is a dis-

cussion of the author's conception of certain mitochondrial bodies, varieties of which, called chondriomes, are morphologically alike but physiologically distinct, and preserve their individuality during the whole course of their development. Plastids are considered as one of such varieties.

The evolution of the chondriome and of plastids in the Fucaceæ, G. MANGENOT (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 1, pp. 63–65, fig. 1*).—Studies outlined as applied to *Fucus vesiculosus* and *F. platycarpus* are said to show that the apical cell of Fucus contains phæoplasts fully formed. Discussion is given of other bodies present in the cell and of their probable significance.

The evolution of the chromatophores and the chondriome in the Florideæ, G. MANGENOT (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 26, pp. 1595–1598, fig. 1*).—A study of certain red algæ shows in one family the existence of two sorts of mitochondria Those of one sort persist without much visible change throughout the whole course of ontogeny, and without displaying any functional activity. Those of the other sort, which are elaborated from the green pigment, undergo considerable changes.

Geo-presentation and geo-reaction, E. O. SCHLEY (*Bot. Gaz., 70 (1920), No. 1, pp. 69–81, figs. 5*).—In continuation of work previously reported (E. S. R., 30, p. 429), this paper deals with the changes in metabolism of the carbohydrates, the difference in osmotic pressure, and the difference in respiration of the upper and lower flanks of the geotropically stimulated shoot through presentation and reaction periods, *Vicia faba* seedlings being employed.

It is found that the reducing sugars remain constant throughout stimulation and response During response, hydrolyzable sugars increase on the convex side at the expense of the polysaccharids. The total of sugars remains constant until the beginning of response, when the sugars of the convex side predominate. Osmotic pressure increases until visible curvature has taken place. At the end of the reaction osmotic pressures are greater than in the normal shoot, being equal on the two flanks. Respiration is increased in the geotropically stimulated root, being greater on the convex than on the concave side throughout the period of perception and response, but decreases as the duration of stimulation increases. The successive chemical changes in a geotropically stimulated shoot are increases in respiration, acidity, turgor, and production of hydrolyzable sugars, with corresponding decreases of polysaccharids on the convex side of the responding organ.

Negative osmoses and related phenomena, K. STERN (*Ber. Deut. Bot. Gesell., 37 (1919), No. 8, pp. 334–343*).—Citation and explanation are given of observed facts involving negative osmosis in plant protoplasts.

Negative pressure in detached transpiring shoots, M. NORDHAUSEN (*Ber. Deut. Bot. Gesell., 37 (1919), No. 9, pp. 443–449*).—A somewhat detailed account is given of the application and results of the method previously employed (E. S. R., 42, p. 334; 43, p. 131).

The transmission of stimulus causing tropism, P. STARK (*Ber. Deut. Bot. Gesell., 37 (1919), No. 8, pp. 358–363, figs. 13*).—Traumatic stimulation obtained by touch with silver nitrate or a hot glass rod was found to be transmissible past the point of union in case of removal and replacement of coleoptile tips, whether use was made of the same individual, different individuals, different species, or different genera of cereal plants.

Heliotropism in assimilating cells of Marchantiaceæ, J. LIESE (*Ber. Deut. Bot. Gesell., 37 (1919), No. 7, pp. 293–298, figs. 4*).—Studies applied chiefly to palisade cells of *Fegatella conica* and *Marchantia polymorpha* are described as still in progress.

Phototropism in plants, I, II, H. VON GUTTENBERG (*Ber. Deut. Bot. Gesell., 37 (1919), No. 7, pp. 299–310*).—Of the two sections of this contribution, the first deals with the relation between the phototropic reaction and the area of the illuminated portion; the second, with the nature of light perception. The work is to be carried forward, particularly as related to antagonistic stimulation accompanying parallel illumination.

[Phototropic behavior of Avena coleoptiles], W. NIENBURG (*Ber. Deut. Bot. Gesell., 36 (1918), No. 8, pp. 491–500, figs. 3*).—It is noted that a coleoptile of Avena, illuminated along a strip parallel to its axis, showed a tendency to bend toward the center line of the illuminated strip.

Effects of different light wave lengths on plants, F. SCHANZ (*Ber. Deut. Bot. Gesell., 37 (1919), No. 9, pp. 430–442, figs. 9*).—Experimentation previously noted (E. S. R., 42, p. 333) having shown that plants are profoundly affected as regards development by light rich in certain wave lengths, the author extended this work and gives herein results in detail as regards the effects on different plants of waves ranging mainly from 300 to 400 $\mu\mu$ in length.

Development of green color in darkness, H. COUPIN (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 18, pp. 1071, 1072*).—A study of pines is said to show that differences exist between the manner of acquisition of green by plants germinated in darkness and that of plants under illumination. These differences, which involve two kinds of chlorophyll and other contrasts, are discussed.

Chlorophyll production in plants intermittently illuminated, H. COUPIN (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 7, pp. 403–405*).—Experimentation intended to ascertain the time and period relations of light exposure to chlorophyll production is said to show that the time exposure for each day needed to start chlorophyll production varies greatly with the species employed. Those parts containing abundant reserve materials, as cotyledons, turn green very rapidly, parts developing green least rapidly containing little or no reserve materials.

Causes of stem elongation in etiolated plants, H. COUPIN (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 3, pp. 189–191*).—It is thought from the results of studies outlined that the dwarfing of plants grown under exposure to light, as compared with the development of such plants kept in darkness, is due to the production of chlorophyll by the chloroleucytes which set free in such plants an internal secretion retarding growth. Plants growing in darkness develop longer stems on account of the lack of assimilation due to the absence of chloroleucytes and of luminous rays.

Variation in the respiration of leaf cells with age, M. BÉZAGU (*Compt. Rend. Acad. Sci. [Paris], 169 (1919), No. 16, pp. 701, 702*).—Following up the studies reported by Nicolas (E. S. R., 41, p. 329) and employing as material *Robinia pseudacacia, Pinus silvestris, Cobæa scandens, Ligustrum vulgare, Althæa, Loroglossum hircinum,* and *Cercis siliquastrum,* the author found that the intensity of respiration, while weak in very young plants, increases to a maximum at their maturity, after which it declines. The respiratory quotient, which is very low in young plants, increases rapidly to a maximum, after which it decreases slowly to maturity and thereafter with regularity. These maxima thus appear at widely different stages in the development of the cell.

[A study of water movement in plants], III, A. URSPRUNG and G. BLUM (*Ber. Deut. Bot. Gesell., 37 (1919), No. 9, pp. 453–462*).—A detailed account of the study of negative pressure in detached leaves of *Hedera helix* exposed to drying gives discussion of the data obtained, which are presented in tabular form.

Pectin relations of Sclerotinia cinerea, J. J. WILLAMAN (*Bot. Gaz.*, *70* (*1920*), *No. 3*, *pp. 221–229*).—" *S. cinerea*, when grown on a fruit juice containing soluble pectin, coagulates this pectin to a gel of calcium pectate by means of the enzym pectase. When simple sugars are available, the fungus does not assimilate pectic substances. When, however, pectin alone is available, it is slowly assimilated. The mycelium contains no pectic substances, except such as occur in particles of calcium pectate gel enmeshed by the hyphal filaments. When the fungus invades a tissue, it follows the line of the middle lamella by dissolving out the latter with the enzym pectosinase. It probably reprecipitates the pectin of the lamella as calcium pectate. The latter, being a hydrophyllic gel, maintains the firmness of the fruit even after rotting, which is a characteristic of fruit rotted by Sclerotinia. This highly imbibing gel is probably also of service to the fungus at subsequent periods by aiding the organism in acquiring a water supply. The production of pectinase is postulated but not demonstrated."

Relation between the formation of acid and that of nitrogenous material in leaves, A. MEYER (*Ber. Deut. Bot. Gesell.*, *36* (*1918*), *No. 8*, *pp. 508–514*).—Brief discussion is given of three of the four relations claimed to have been demonstrated in the chloroplasts of leaf cells, particularly involving nitrogenous material, organic acid, and calcium oxalate.

Sulphocyanic acid in plants, S. DEZANI (*Biochim. e Terapia Sper.*, *6* (*1919*), *No. IV–VI*, *pp. 95–104*).—This preliminary note deals with the presence, diffusion, and significance of sulphocyanic acid, chiefly in *Brassica oleracea*.

[Indo-Chinese maniocs rich in nitrogen], P. AMMANN (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 22*, *pp. 1333, 1334*).—Comparative analyses are given of maniocs from different localities, showing in certain new varieties from Indo-China a high nitrogen content associated with a low content of hydrocyanic acid.

The distribution and movement of copper in green plants, L. MAQUENNE and E. DEMOUSSY (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 2*, *pp. 87–93*).—The copper content of a number of plants is given. Copper appears to migrate and accumulate in plants as the result of processes apparently nutritive and not merely physical or chemical in character. The question is raised as to its actual utility in plants.

Conditions modifying the action of chloropicrin on higher plants, G. BERTRAND (*Compt. Rend. Acad. Sci.* [*Paris*], *170* (*1920*), *No. 16*, *pp. 952–954*).—The conditions studied in this connection are concentration, duration of treatment, temperature, illumination, and humidity.

The effects of illuminating gas on plants, C. WEHMER (*Ber. Deut. Bot. Gesell.*, *36* (*1918*), *No. 8*, *pp. 460–464*).—The author has carried forward work previously noted (E. S. R., 42, p. 730; 43, p. 523). The present account emphasizes the effects on woody plants of prussic acid, which is said to be the most injurious agent of this kind.

[Tar vapor injury and other acute fume injuries to plants], R. EWERT (*Landw. Jahrb.*, *50* (*1917*), *No. 5*, *pp. 695–832*, *pls. 2*).—An extended study is noted of the injury done to vegetation by gas and smoke products, which are dealt with in detail in their connection with different plants.

Smoke injury from coke ovens, WIELER (*Jahresber. Ver. Angew. Bot.*, *16* (*1918*), *No. 2*, *pp. 64–76*).—An account is given of injury or death to forest growths ascribed to emanations from coke ovens present in large numbers in three localities.

FIELD CROPS.

[Report of field crops work in Oregon, 1918–1920] (*Oregon Sta. Rpt. 1919–20, pp. 30–34, 52, 53, 65, 66, 72–75, 80*).—Work with field crops at the station included variety, cultural, fertilizer, rotation, and breeding tests with forage crops in cooperation with the Office of Forage Crop Investigations, of the U. S. Department of Agriculture; variety, breeding, cultural, and nursery work with cereals; variety and cultural tests with flax; various tests with potatoes; curing tests of hay; and experiments with silage.

Common vetch, purple vetch, hairy vetch, woolly-podded vetch, Hungarian vetch, and Tangier peas showed the most promise in comparative trials of vetches. Early fall seedings of purple vetch alone, and from 60 to 80 lbs. of common vetch with 40 lbs. of oats per acre, gave the best results in cultural tests. Early fall planting proved superior to spring planting. Although fall seedings of red clover, with or without companion crops, often fail to survive, early spring seedings, with companion crops, are usually good. Late spring seedings, alone, are satisfactory. Trials of sweet clover, soy beans, horse beans, miscellaneous legumes, grasses, and pasture mixtures are also noted.

Leading cereal varieties in the tests include White winter wheat, Red Fife and Huston spring wheat, Gray winter oats, Three-grain, Victory, and Swedish Select spring oats, and Minnesota 23 and Minnesota 13 corn.

In eradication studies of horsetail fern, bog clover, and fall dandelion in cranberry bogs by means of chemical sprays, solutions of 1 lb. of iron sulphate to 1 to 3 gal. of water killed about 20 per cent of the fern, injuring the cranberries to the extent of 25 per cent. Arsenite of soda, in solutions at the rate of 1 lb. to 8, 10, and 12 gal. of water, killed about 90 per cent of fern in the strongest form, injuring about 50 per cent of the cranberries, while the weakest solution killed 40 per cent of the fern and burned the leaves of cranberries but slightly. Carbolic acid and copper sulphate solutions failed to produce results. Arsenate of soda was the only chemical to give beneficial results on bog clover. Solutions of 1 lb. to 6 gal., 1 lb. to 8 gal., and 1 lb. to 10 gal. killed about 70, 60, and 40 per cent, respectively, of the clover without injuring the berries.

Variety and cultural tests, and rotations with cereals, legumes, and root crops were conducted at the Harney Substation. Earlier work along the same lines has been noted heretofore (E. S. R., 39, p. 227).

The leading varieties in trials under dry-land farming and their average acre yields for a period of years are as follows: Early Baart spring wheat, 7 years, 15.7 bu.; Turkey Red winter wheat, 7 years, 12.2 bu.; Sixty-day oats, 8 years, 20.7 bu.; Hannchen barley, 7 years, 19.1 bu.; Baltic alfalfa (in rows), 6 years, 1.1 tons; and Bliss Red Triumph potatoes, 5 years, 53.7 bu. The highest 3-year average yields under irrigation were made by Early Baart spring wheat, 15.5 bu.; Rustless oats, 32.7 bu.; Hannchen barley, 35.6 bu.; Baltic alfalfa, 4.4 tons; and Extra Early Rose potatoes, 110.9 bu.

Results of date and rate of seeding tests indicate that the best times for seeding are as follows: Spring wheat without irrigation, about April 10; spring barley, about May 1 to 10; spring oats, April 15; and spring rye, April 15 to 25. Optimum rates per acre were for spring wheat on dry land 30 lbs., spring barley 40 to 48 lbs., oats 1 bu., and spring rye 1 bu.

Experimental work on the Sherman County (Moro) Dry-farm Substation conducted in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, in continuation of earlier work (E. S. R., 37, p. 529) included variety trials, cultural experiments, rotations, and cereal breeding investigations.

Foremost in variety trials were Mariout and Meloy beardless barley. Sixty-day and No. 357 oats, O'Rourke, Carleton, and Bangalia field peas, and Minnesota 13 and Walla Walla White Dent corn.

In tillage experiments conducted from 1913 to 1919, inclusive, average acre yields of Turkey winter wheat after fallow were as follows: Plowed April 1, May 1, and June 1, 28.7, 26.2, and 22.2 bu., respectively; plowed early in the fall (dry) with moldboard plow, 26.1 bu., and with disk plow, 23.2 bu.; and plowed late in the fall (wet) with moldboard plow, 22.5 bu., and with disk plow, 22.3 bu.

The results of eight years' experiments with various methods of cultivating summer fallow after plowing, indicate that the growth of weeds on summer fallow reduces wheat yields and injures the milling quality. Subsurface or surface packing of ground to be left fallow does not ordinarily increase wheat yields. After a mulch has been established, further cultivation of summer fallow for any other purpose than killing weeds is unnecessary. The cultivation of land plowed late in the spring, when the ground is dry, is of no value, neither conserving moisture nor increasing wheat yields. Harrowing winter wheat in the spring usually reduces yields.

The most profitable crop rotations in the experiments were spring wheat, barley, potatoes; field peas continuously; and spring wheat, corn, spring barley.

[Report of field crops work in Montserrat, 1918–19], F. WATTS (*West Indies Imp. Dept. Agr., Montserrat Agr. Dept. Rpt., 1918–19, pp. 4–16, 20–23, 31–34, 35–38, 41–45*).—Continuing work noted heretofore (E. S. R., 41, p. 825), this reports the progress of breeding, variety, spinning, cultural, and fertilizer tests with cotton; variety tests with sugar cane; observations on the utilization of *Datura metel* as a source of scopolamin; notes on peas, beans, peanuts, sweet potatoes, and yams; comparisons of the Bengal bean (*Stizolobium aterrimum*), fleshy pod bean (*S. pachylobium*), Lyon bean (*S. niveum*), and white velvet bean (*S. deeringianum*) for green manuring purposes; and information relative to the cotton and sugar industries.

[Report of field crops work in Nigeria, 1919], A. H. KIRBY (*South. Provs. Nigeria, Dept. Agr. Ann. Rpt. 1919, pp. 5–10*).—In continuation of similar work previously noted (E. S. R., 42, p. 436), this describes variety and cultural tests with cotton, corn, peanuts, beans, sugar cane, indigo, and yams conducted at several points in southern Nigeria.

[Field crops work in South Australia], A. J. PERKINS and W. J. SPAFFORD (*So. Aust. Min. Agr. Rpt. 1919, pp. 8–14, 32–34, 35, 36, 37, 38, 39–41*).—Data are summarized from variety tests and rotations of cereals and forage crops, cultural and fertilizer trials of wheat, and field tests of sugar beets and flax conducted during the year ended June 30, 1919.

A manual of farm grasses, A. S. HITCHCOCK (*Washington: Author, 1921, pp. X+175, figs. 36*).—This volume, designed for the use of farmers, stockmen, and experiment station workers, gives information by which cultivated grasses may be identified and their range, adaptability, and uses determined. Special attention is accorded to statistics of the grass crop; cultural methods; structure of grasses; the three leading forage grasses, timothy, bluegrass, and Bermuda; annual forage crops; native forage grasses; and weedy grasses. A brief account of grasses used for lawns and ornamental purposes is also included.

Breeding methods in forage plants, M. O. MALTE (*Sci. Agr., 1 (1921), No. 1, pp. 25–29, figs. 4*).—This paper deals with practical methods applicable to the breeding of grasses, alfalfa, and red clover under conditions existing in western Canada.

Indian trade inquiry.—Reports on oil seeds, C. C. McLeod, C. H. Armstrong, et al. (*London: Imp. Inst., 1920, pp. VIII+149*).—This volume comprises two parts, as follows:

I. *The trade in Indian oil seeds* (pp. 1–74).—A general discussion of the oil seed trade in India and of the conditions of the industry in the principal European markets for Indian oil seeds. Considerable statistical data regarding production, consumption, and trade are appended.

II. *The Indian trade in oil seeds* (pp. 75–149).—A summary of general information, with a special section considering separately the following seeds and their products: Cotton, flax, niger, rape, mustard, poppy, peanuts, sesame, castor, mowra, shea, illipé, Sierra Leone butter seeds, and copra.

Studies of Brazilian varieties of cassava, L. Zehntner (*Estudo sobre Algumas Variedades de Mandiocas Brasileiras. Rio de Janeiro: Soc. Nac. Agr., 1919, pp. 112, pls. 13, fig. 1*).—Detailed botanical descriptions of 74 varieties of cassava grown in Brazil are presented, together with considerable agronomic data including comparative yields, plant, root, and leaf measurements, and growth periods. The several varieties are classified in a descriptive key. Results of chemical analyses and comprehensive variety, cultural, and selection tests, and type studies are set forth in tabular form and fully discussed.

Corn growing in Michigan, J. F. Cox and J. R. Duncan (*Michigan Sta. Bul. 289 (1920), pp. 48, figs. 36*).—The leading corn varieties of Michigan are described and their origin and approximate sectional adaptation indicated. The selection, curing, storage, and testing of seed corn, the place of the crop in the rotation, fertilizing, cultural, and field practices involved in growing the crop, harvesting methods, and corn improvement through intensified selection are discussed in a general manner. Brief notes on Indian methods of corn culture and a short discussion on the control of corn smut by G. H. Coons are included.

Maximum acre yields in variety tests at the station in 1919 were made by Golden Glow, Folks White Cap, and Duncan Yellow Dent with 86.4, 81.6, and 78.3 bu., respectively. A summary of the 24 variety tests conducted in different localities in the State showed an average range of 23.77 bu. between the acre yields of the highest and lowest yielding varieties.

Corn breeding as a hobby, H. A. Wallace (*Wallaces' Farmer, 46 (1921), No. 3, p. 103, figs. 3*).—Experiments to secure a hybrid corn consistently better than Reid Yellow Dent for Iowa conditions are described. Eight late varieties used as the pollinating parents on 20 yearly varieties produced 160 combinations. In tests of the crosses at Ames and Des Moines, Reid Yellow Dent averaged the best of the 8 varieties as a pollinating parent and a Kentucky strain of Johnson County White, the poorest. Of 287 crosses tried at Ames from 1916 to 1919, inclusive, but 50 outyielded the check. Johnson County White×Silver King, Iowa 119×Argentine, and Biggs Seven-Ear×Iowa 203 led the list, yielding 138.5, 131, and 126 per cent, respectively, of the check.

The author points out the need of special-purpose corn varieties for silage, 90-day maturity, 35 bu.-land, 75 bu.-land, high-oil content, etc., and considers from the work of Shull, East, and Jones that the most certain and rapid progress in the development of special-purpose strains or varieties can be made by developing pure strains by inbreeding and then combining inbred strains into first generation hybrids. He suggests the organization of an association for recording promising pure strains of corn after they have selfed for four years and reduced to a certain degree of homozygosity. Various agronomic data, particularly the degree of homozygosity, would be determined by tests of the strain at the State experiment station, and having passed these tests, the pure strain would be given a number in the "herd" book. Growers of inbred

strains would sell their best strains for good prices to men "specializing on the commercialization of first generation hybrid or double-cross seed."

A study of nitrogen and root space as factors limiting the yield of maize in Egypt, J. A. PRESCOTT (*Sultan. Agr. Soc., Tech. Sect., Bul. 4 (1920), pp. 14, figs. 6*).—In experiments concerning nitrogen and root space as limiting factors in corn yields, the response of the corn crop to nitrate of soda is said to have followed very closely the mathematical expression of Mitscherlich (E. S. R., 25, p. 825) relating to the law of the limiting factor. "In the original Mitscherlich formula $\frac{dy}{dx}=c(A-y)$ or $\log (A-y)=K-cx$. Where y is the yield obtained when x is the amount present of the factor limiting the growth of the plant, A is the maximum yield obtainable if the factor is in excess. c and K are constants."

A steady increase in crop yields accompanied each increase in the rate of fertilizer application up to 300 kg. per feddan (631 lbs. per acre). At the highest rate, 400 kg. per feddan, some depressing factor was introduced. No retardation of the rate of maturity was observed. The same expression held with fair agreement when the root space was taken as the variable factor.

Cotton production and distribution, seasons of 1918–19 and 1919–20 (*Bur. of the Census [U. S.] Buls. 140 (1919), pp. 135, figs. 15; 145 (1920), pp. 135, figs. 17*).—Tabulated statistical data similar to those noted previously (E. S. R., 40, p. 238) are presented for the seasons of 1918–19 and 1919–20.

"Kumpta" cotton and its improvement, G. L. KOTTUR (*India Dept. Agr. Mem., Bot. Ser., 10 (1920), No. 6, pp. [III]+221–273, pls. 7, figs. 17*).—This memoir describes the characteristics of *Gossypium herbaceum*, the species to which "kumpta" cotton belongs, and gives an account of studies of the characters of the various strains of "kumpta" cotton as they occur in the fields near Dharwar, Bombay Presidency. Work in isolating and developing promising cultural and trade types is outlined, and detailed agronomic data and notes on the variability of the several characters are set forth in tabular and diagrammatic form.

Industrial research associations.—III, The British Cotton Industry Research Association, A. W. CROSSLEY (*Nature [London], 106 (1920), No. 2665, pp. 411–413*).—The organization and development of the association are outlined briefly, and the nature of the research work to be undertaken is described.

Flax fiber and tow grading, R. J. HUTCHINSON (*Agr. Gaz. Canada, 8 (1921), No. 1, pp. 23, 24*).—A brief discussion of the principles involved in judging flax fiber and tow, together with suggested grades.

Some aspects of the indigo industry in Bihar.—II, The factors underlying the seed production and growth of Java indigo in Bihar, A. and G. L. C. HOWARD ET AL. (*India Dept. Agr. Mem. Bot. Ser., 11 (1920), No. 1, pp. 27–36, figs. 2*).—The yield of indigo seed depends on two factors, fertilization and the rapid growth of the plant. The six weeks of warm, dry weather between October 15 and November 30 is considered the optimum period for fertilization.

Results of investigations of the effect of aeration and organic matter on seed production indicated that improved aeration by itself had a marked effect, seed production being nearly tripled and growth almost doubled by the substitution of 10 per cent of the volume of soil by potsherds in the pot cultures. The replacement of half the soil by sand gave like results. Replacing 40 per cent of the volume of the soil by leaf mold (30 per cent) and potsherds (10 per cent) increased seed production 21 times and growth more than tenfold. These results were confirmed both in the field and in other series of pot cultures. The effect of temperature was shown by the decline of growth rate which took

place in all the pots after the end of November, no matter what treatment was accorded.

The conditions affecting the quality of the Java indigo plant (leaf yield and richness of the leaf in indigotin), W. A. Davis (*Agr. Research Inst. Pusa, Indigo Pub. No. 7 (1920), pp. 33*).—Trials at Pusa to ascertain the effect of growing a cover crop with indigo on the quality and yield of the indigo crop are reported.

Although indigo intercropped with wheat grew slowly following the removal of the wheat, it made rapid growth after the monsoon rains and gave an exceptional quality of plant with a very high percentage of indigotin in the leaf. The percentage of indigotin appeared to be determined largely by the amount of readily available nitrogen in the soil, a profuse plant growth with a leaf very poor in indigotin resulting from a high amount of available nitrogen. Cover crops grown with indigo probably improve the quality of the leaf by removing the excess of available nitrogen. It is also thought probable that the activity of nodule organisms determines high indigotin content, and that the production of indican is due to the action of the plant in removing from the nodules compounds that would be prejudicial to their continuous action.

Orchard grass (Dactylis glomerata), A. Zade (*Arb. Deut. Landw. Gesell., No. 305 (1920), pp. 69, pls. 3, figs. 9*).—Detailed descriptions of orchard grass (*D. glomerata*) and its habits of growth and propagation are presented, together with discussions of the origin, nomenclature, culture, and forage value of the grass; cultural practices involved in the production of seed and forage; diseases and insect enemies; and breeding methods.

How to grow an acre of potatoes, W. Stuart (*U. S. Dept. Agr., Farmers' Bul. 1190 (1921), pp. 28, figs. 14*)—Simple directions, especially designed for boys and girls, are outlined covering the kind of potatoes to grow, selection and preparation of land and seed, planting, cultivation, combating insect pests and plant diseases, roguing and selecting seed, harvesting, grading, and storage.

The effect on the growth of rice of the addition of ammonium and nitrate salts to soil cultures, S. F. Trelease and P. Paulino (*Philippine Agr., 8 (1920), No. 8-9, pp. 293-313, figs. 3*).—Experiments reported in this paper were conducted at the College of Agriculture, Los Baños, P. I., to compare the effects of nitrogenous salts on the yields of rice in soil cultures. Each culture was supplied with a three-salt mixture composed of primary calcium phosphate, potassium sulphate, and one nitrogenous salt, either ammonium sulphate, ammonium nitrate, calcium nitrate, or sodium nitrate. Four groups of cultures were employed, each using a different nitrogenous salt but supplying the same molecular amount of nitrogen.

The water-saturated soil used as a culture medium in these experiments was a clay loam, previously cropped with sweet potatoes, and the salts were supplied in addition to those already present in the soil. In each group of cultures 15 sets of proportions of three salts were added to the soil, with each salt varying from set to set by increments of one-seventh of the total salt content of the mixture, which was osmotically the same in all sets. Yields of grain and straw and other agronomic data, together with index values showing the relative yield of straw and grain per unit of molecular nitrogen added to the cultures, are included in tabular form.

Under the conditions of the experiments, neither grain nor straw yields were correlated in a definite way with the proportions of either primary calcium phosphate or potassium sulphate, and increased yields did not accompany higher proportions of these salts. Yields of straw and grain were, however, directly related to the proportions of nitrogenous salts in the fertilizer mixtures, high

yields being correlated with high proportions and low yields with low proportions. This was true with all the forms of nitrogen.

Considering both straw and grain yields, the best cultures supplied with ammonium sulphate, ammonium nitrate, calcium nitrate, and sodium nitrate gave respective yields of about 9.6, 6.5, 3, and 3.2 times that of the control culture which received no fertilizer, indicating that ammonium nitrogen was much more effective than nitrate nitrogen in increasing the yield of both straw and grain. However, nitrate nitrogen should not be regarded as without influence upon rice growing in water-saturated soil.

For every set of salt proportions, yields of grain and straw per unit of molecular nitrogen added to the cultures were highest when the nitrogen was added as ammonium sulphate; lower when the nitrogen was supplied as ammonium nitrate; and still lower when the nitrogen was supplied as calcium nitrate or as sodium nitrate.

The proportions of primary calcium phosphate and potassium sulphate appeared to have slight influence upon the relationship between the nitrogenous salts and the yields.

The growth of rice as related to proportions of fertilizer salts added to soil cultures, S. F. Trelease (*Philippine Jour. Sci., 16 (1920), No. 6, pp. 603–629, figs. 5*).—A detailed discussion of the experiments reported above.

Indian trade inquiry.—Reports on rice, C. C. McLeod, M. F. Reid, et al. (*London: Imp. Inst., 1920, pp. XIX+164*).—The following reports are included:

I. *The trade in Indian rice* (pp. 1–68).—A general discussion dealing with the Indian rice trade with the United Kingdom, British Empire, and Europe, and the comparative costs of handling, milling, and transportation of rice in these countries. Statistics of the rice trade of various countries in southern Asia, western Europe, the British Empire, the United Kingdom, and the United States are appended, together with the import and export duties on rice in the various countries of the world.

II. *The production and uses of rice* (pp. 69–155).—A summary of general information concerning the production of rice and its commercial movement in the British Empire and other countries, and the uses of rice.

III. *The utilization of Burmese rice and its by products* (pp. 156–164).—This reports results of investigations of the suitability of Burmese rice for industrial and other purposes and the uses of rice straw and hulls for paper making. See also a previous note (E. S. R., 41, p. 533).

Farm practices with soy beans, A. G. Smith and C. E. Hope (*N. C. Dept. Agr. Bul., 41 (1920), No. 5, pp. 30, figs. 7*).—Based on information secured from a survey in 1916 of 50 farms in five counties in northeastern North Carolina where soy beans were grown as a major farm crop, this publication discusses the cropping systems, regional characteristics, varieties, cultural and harvesting operations and their man and horse labor requirements, distribution of labor, cost of production, and factors influencing yields of hay and beans.

Soy beans, on the 50 farms studied, yielded from 4 to 39 bu. per acre, and averaged 19 bu. when planted as the first crop and 18.8 bu. when planted as the second crop. On the best soils the yield frequently exceeded 25 bu. per acre. Yields of other crops on the same farms the same year averaged as follows: Seed cotton 1,149 lbs., corn 29.7 bu., and oats 44 bu. The crop area planted per man and per work animal varied with the type of soil and the combination of crops, but averaged per work animal 20 acres.

Effect of heat on sugar beet seed, E. Saillard (*Bul. Mens. Off. Renseig. Agr. [France], 19 (1920), April–June, pp. 236, 237; also in Compt. Rend. Acad. Agr. France, 6 (1920), No. 11, pp. 308–311*).—Sugar beet seed of very good, good,

and ordinary quality was submitted to temperatures of 40, 50, 60, 70, 80, 90, 100, and 105° C. for 1-hour periods. A second series of the same seed was subjected to temperatures of 80, 100, and 105° for 15, 30, 45, and 60 minutes, respectively. The heated seed was then tested for germination along with check lots of untreated seed.

Results of the experiment showed that glomerules of seed germinating 98 per cent and good commercial seed germinating 87 per cent retained their viability when submitted to temperatures of 60 and 70°, while ordinary seed germinating but 36 per cent was nearly all killed. Subjection to 80° for as long as an hour retarded the germination of the better grades of seed but did not change the percentage of germination at the end of 14 days. Temperatures above 80° suitably applied killed the inferior glomerules and spared the good, thus indicating a means of physical selection.

Experiments with varieties of sugar cane, H. A. Tempany (*Mauritius Dept. Agr., Gen. Ser., Bul. 20 (1920), [English ed.], pp. 8*).—Results of varietal experiments in progress during the years 1917–1919 are reported. The field characters and internode and eyebud characters of 83 cane varieties are described in detail. Leading varieties in order of merit included D 109, R. P. 6, 291^{08}, B 3390, and B 6308 with respective acre yields of 39.9, 39.8, 36.8, 36.2, and 35.5 tons of cane with a sucrose content of 14.25, 13.85, 14.66, 15.21, and 15.42 per cent, respectively.

The sweet potato, T. E. Hand and K. L. Cockerham (*New York: Macmillan Co., 1921, pp. XI+261, pls. 8, figs. 50*).—A handbook for the practical grower of sweet potatoes. The successive chapters deal with the origin and description of the sweet potato; importance and distribution; utilization; propagation; tillage, fertilization, and rotation; varieties; insects and diseases of the sweet potato; insecticides, fungicides, and spray machinery; harvesting and storage; preparation for market; and commercial disposal of the sweet potato.

California wheat varieties, G. W. Hendry (*Amer. Miller, 49 (1921), No. 3, p. 291, fig. 1*).—Descriptions of the seven wheat varieties grown extensively in California are presented. Acre yields in 1920 at University Farm, Davis, Calif., were as follows: Pacific Bluestem 58.5 bu., California Club 47.6, Defiance 42.3, Early Baart 41.2, Hard Federation 37.1, Turkey Red 33.3, and Sonora 32.4 bu.

The inheritance of glume-length and grain-length in a wheat cross, F. L. Engledow (*Jour. Genetics, 10 (1920), No. 2, pp. 109–134, fig. 1*).—Investigations to ascertain the precise manner of inheritance of simply measurable characters in wheat are reported. Pure lines of Polish wheat and Kubanka were crossed, the F_1, F_2, and F_3 generations of the cross grown, and measurements of the glume and grain lengths taken on the plants in each generation. The behavior of the individuals in the several generations is discussed in detail, frequency distributions of glume and grain lengths are tabulated, and a bibliography of literature cited is appended.

In this cross, length of glume appeared to segregate simply and in the F_2 the ratio long: intermediate: short=1:2:1. The "longs" and "shorts" of F_2, although recognizably of the same form as the parents (F_0), differed from them in mean glume-length. The average of the longs was reduced by 24.8 per cent of the F_0 value. In the case of the F_2 shorts, a smaller increase over the F_0 shorts was noted. This change or "shift" in the longs of the F_2 was quite definite, and could not be explained by errors of sampling, seasonal variation, or similar causes. The shifted form of longs of F_2 bred true as far as F_3, but had not been carried farther.

When, in the selfing of F_2 heterozygotes, plants of parental type were again evolved there was no evidence of super-added shift. Likewise there was no

evidence of a tendency to the restoration of F_0 values of mean glume-length. Results analogous to the foregoing were obtained for grain-length. The percentage value of the shift was, however, less than it was for glume-length.

The author holds that all the available evidence supports the view that grain-length and glume-length belong to the same generation or, differently expressed, that grain-length is a maternal character. He finds that it is difficult to harmonize this view with the double-fertilization hypothesis, as numerous grain and glume characters appear to be genetic inseparables, long-type glumes never containing short-type grains, and vice versa. Despite the association of glume-length and grain-length, the correlation between these two variables is low.

A development of hairs, far more marked than that exhibited by either parent variety, was found in certain of the F_2 plants. These plants were all of short-glume type. Length of glume appeared in some manner to inhibit the full development of hairs. The inheritance of hollow and solid straw was found to be complicated, and it is thought that a relationship may possibly exist between shift in glume-length and nature of straw inheritance.

The protein content of wheat grown with irrigation, J. S. Jones, C. W. Colver, and H. P. Fishburn (*Jour. Agr. Sci.* [*England*], *10* (*1920*), *No. 3*, *pp. 290–332*, *figs. 11*).—The data reported in this contribution from the Idaho Experiment Station has been noted from another source (E. S. R., 41, p. 535).

Weeds of farm land, W. E. Brenchley (*London and New York: Longmans, Green & Co., 1920*, *pp. X+239*, *pls. 2*, *figs. 38*).—This volume presents considerable information on the weeds of crops and on farm lands with special reference to conditions prevailing in Great Britain. The work comprises chapters on the distribution and growth habits of weeds; vitality of weed seeds, prevention and eradication of weeds; parasitic, poisonous, and injurious weeds; weeds of grassland; and the uses of weeds. The quantitative and qualitative relations existing between weeds, the soil on which they grow, and the crops with which they are associated are discussed at some length. A list of the popular and local names of British weeds is included.

Fifty important weeds of Montana, D. B. Swingle, H. E. Morris, and E. W. Jahnke (*Mont. Agr. Col. Ext.* [*Pub.*], *No. 45* (*1920*), *pp. 126*, *figs. 108*).—This publication describes and illustrates the plants and seeds of 50 important weeds of Montana, discusses briefly their methods of propagation, time of flowering, occurrence, sources, and relative importance, and indicates practices found most effective in the control and eradication of each.

Control of Cuscuta, A. de Rosa (*Coltivatore, 66* (*1920*), *No. 24*, *pp. 594–597*).—For the control of Cuscuta sulphuric acid at 4 to 5 per cent is preferred to arsenite of potash.

HORTICULTURE.

Report of the department of horticulture (*Oregon Sta. Crop Pest and Hort. Rpt. 3* (*1915–1920*), *pp. 7–57*, *figs. 23*).—The horticultural papers included in this third report are: The December Freeze, Some Lessons from It, by W. S. Brown (pp. 9–14), noted on page 821; Some Relations of Growth and Bearing of Fruit Trees to Orchard Practices, by E. M. Harvey and A. E. Murneek (pp. 15–19); Summer Pruning of Young Apple Trees, by E. M. Harvey (pp. 20–26); The Storage of Bosc Pears, by A. E. Murneek (pp. 27–32); Vegetable Greenhouse Crops in Relation to the Use of the Greenhouse for One Season (pp. 33–35), Factors Affecting Production and Marketing of Broccoli (pp. 36–39), and Factors Affecting Shrinkage and Condition of Broccoli (pp. 40, 41), all by A. G. B. Bouquet; Cherry Breeding (pp. 42, 43) and Pollination of the Ettersburg No. 121 Strawberry (pp. 44–46), both by C. E. Schuster; Depth of Plant-

ing in Relation to Tree Growth, by H. Hartman (pp. 47, 48); Fertilizer Experiments with Fruits, by L. P. Wilcox (pp. 49–51); and Some Investigations on Prune Drying, by E. H. Wiegand (pp. 52–57), noted on page 809.

The paper on the relation of growth and bearing of fruit trees to orchard practices points out the necessity of more fundamental studies of the principles which underlie orchard management practices and of ascertaining a method of determining the true condition prevailing in an orchard. The nitrogen-carbohydrate theory, as outlined by Kraus and Kraybill (E. S. R., 40, p. 40), is analyzed in relation to its bearing on orchard practices.

Summer pruning of young Gano and Rome Beauty trees was studied in relation to the effect on growth and fruit-spur formation. A similar experiment with other varieties has been previously noted by Gardner (E. S. R., 36, p. 237). Four methods of treatment were employed, (1) winter heading and winter thinning, (2) summer heading and summer thinning, (3) winter heading and summer thinning, and (4) summer heading and winter thinning. Results are based on data taken on 70 trees of each variety and treatment.

"All types of summer pruning have allowed less tree growth than winter pruning only. Fruit-spur formation apparently has not been stimulated by summer pruning as compared with the winter pruning only. The failure to respond in this respect to summer pruning may be attributed to the characteristic bearing habits of the Rome and Gano. Likewise the amount of fruit harvested this season was less from summer-pruned trees than from those which had received winter pruning only. Nothing in the results of this series of experiments would justify the recommendation of summer pruning for young trees of such varieties as Rome and Gano. The results of these experiments, when compared with those reported by other investigators working with different varieties, emphasize the necessity of regulating pruning practices in accordance with the natural growing habits of the varieties under consideration. As a general pruning practice in young orchards of any variety, it would seem advisable to do summer pruning with great caution, even though it is recognized that under special circumstances light early summer pruning may be very beneficial."

The storage of Bosc pears was studied in an effort to prolong the keeping period of this important market variety. An earlier report on this work, by Lewis, Murneek, and Cate, has been noted (E. S. R., 42, p. 40). "Time of picking does not very materially influence the storage quality of Bosc pears, excepting that fruit picked very early in the season must be permitted a delay or partial ripening under more humid conditions and for a longer period than when picked later in the season. With the proper precautions, Bosc pears may be kept successfully for three months, or possibly longer, at least for the Christmas trade. Based on our present information, the following storage procedure appears to be the best: Delay for 10 to 15 days, then car temperature storage for 12 to 15 days, then cold storage. To prevent shriveling of 'delayed' fruit, a humidity of 60 to 70 per cent must be maintained in the delay room. The higher the humidity the less time would be required for a 'delay.' Both relatively high temperature with low humidity and low temperature with high humidity are harmful to the proper ripening of Bosc."

A trial of several vegetables to ascertain their adaptability as forcing crops for Oregon greenhouses during the period September to March indicated that spinach, cauliflower, radishes, cucumbers, and tomatoes can be grown profitably. The author concludes that it is clear that there is no good reason why all vegetable greenhouses should not be intensively cropped during the entire growing season.

Cherry breeding studies include a sterility test of 18 cherry seedlings, selected as most promising, from a lot bred for resistance to bacterial gummosis. Of approximately 3,300 blossoms bagged and allowed to self-pollinate, not a single fruit attained maturity.

Depth-of-planting studies with young apple, pear, and prune trees failed to reveal any striking differences in size or vigor of the trees. In refutation of the common opinion that deeply planted trees readily develop roots above the graft, it was found that no roots formed above the graft on pears, a few unimportant roots formed on the apples, and quite a considerable number on the prunes.

Fertilizer experiments with fruits include a test of nitrate of soda on Italian prune trees in three localities. In one case no increase in yield was obtained. In all cases where this fertilizer was applied to prunes, there was a response to the stimulant, more noticeable, however, in their vegetative parts than in their fruits.

In a test of nitrate of soda on red raspberries, a larger berry of better color and stimulation of canes, followed by severe winterkilling, was noted.

[Report on horticultural investigations] (*Oregon Sta. Rpt. 1919–20, pp. 43–50, 52*).—Apple-pruning investigations have continued (E. S. R., 39, p. 42) to receive much attention, great importance being placed on physiological and biochemical studies in determining the relation of different methods of pruning to the food reserves in different parts of the tree. Fruit-spur studies with Grimes, Jonathan, and Wagener apple varieties showed that defoliation of the spurs has a marked effect on flower-bud formation and setting of the fruit.

It was found that the defoliated spurs formed on an average 57.2 per cent as many flower parts as the spurs not defoliated. Chemical analysis showed that defoliation of individual apple spurs tends to throw them into a vegetative or "active" condition, thus increasing their potential for growth, but lowering in proportion their capacity for reproduction. In this the chemical and histological examinations agreed. The general results showed a high degree of individuality in the apple spur and dependence on its own leaves for its activities, Jonathan and Grimes showing more individuality than Wagener.

During the summer of 1919 about 10,000 spurs were under observation to determine the effect of spur defoliation on the setting of the fruit. Records were kept of the actual performance of spurs under different amounts of defoliation, and material was collected from time to time for chemical analysis. The results showed a close correlation between the leaf area of the spur and the average number of fruits per spur, as well as the average weight of the individual fruit. There was again strong evidence of high individuality of the apple spur. The chemical results were not so clear, there being little consistent difference in percentage of carbohydrates and nitrogen in respect to varying amounts of leaf area of the spur. This is probably explained by the fact that old lignified portions of the spur were used in the analysis, since this portion has since been found to be much less responsive than new portions to changed conditions.

Three lots of Gravenstein trees, one heavily fertilized with nitrate of soda, one severely root pruned late in March, and one with no treatment, were used as the basis of a study to determine if leaves may be used as indicators of the internal condition of the tree. Chemical analyses of leaves gathered July 26 showed a marked variation in the carbohydrate-nitrogen ratio, this being for the nitrate of soda lot 6.03, the root pruned lot 9.98, and the check lot 8.48. These data are believed to show that the leaves are probably good indexes of the general internal condition of the tree.

In studies of the effect of pruning on the bearing habit of the tomato, it was found that in respect to number of blossoms and amount of set, the tomato spur "can not be affected very markedly by foliage in close proximity to the spur. It is very possible that a tomato spur, unlike that of the apple, is dependent upon the plant as a whole for its carbohydrate supply. Both pruning and nitrate supply determined amount of growth, blossoming, and setting of fruit of the plant as a whole. Root pruning, even when very severe, had but slight, if any, effect.

"Chemical analysis showed a strict correlation between amount of pruning and percentage of total carbohydrates in the plant, but no strict correlation could be established between amount of pruning and percentage of total nitrogen. All pruned plants were, however, much higher in nitrogen than unpruned ones. Root pruning rather increased than diminished amount of nitrogen in the tomato. The carbohydrate-nitrogen ratio diminished as pruning increased in amount.

"Further studies have shown that blossoms on the tomato will set fruit only when there is a fair amount of foliage on the plant. The removal of leaves almost automatically checks further setting, though there may be an abundance of blossoms present."

Fruit breeding work with the strawberry, apple, cherry, filbert, and walnut is discussed. Pollination studies with Ettersburg 121 were conducted to determine the reason for the poor-yielding character of this strawberry variety.

Tomato pollination studies (E. S. R., 40, p. 833) were continued. Tests of 13 strains of St. Valentine broccoli showed that marked variations exist within a variety.

A comparative test of nitrate of soda and sulphate of ammonia as fertilizers for Cuthbert red raspberries indicated a slight difference in favor of the nitrate. In propagation studies with the filbert it was found that by layering the new shoots directly a year's time can be saved in the growing of new plants.

[Report on horticultural investigations in Illinois] (*Illinois Sta. Rpt. 1919, pp. 16, 17, 18, 19*).—Soil treatment studies with the peach at Olney indicates that clean cultivation promotes more vigorous growth than clean cultivation combined with cover crops. In an overhead irrigation experiment at Urbana, the yield of peppers was materially reduced by irrigation. In a fertilizer test at Anna the yield of tomatoes was materially increased by the use of manure and acid phosphate. A study of first generation apple hybrids indicates that certain Malus species have the ability to completely dominate in the progeny, whether used as male or female parent.

Laws regulating the commerce in plants in Porto Rico, M. A. Crespo and L. T. Catoni (*Porto Rico Dept. Agr. and Labor Sta. Circ. 27 (1920), Spanish ed., pp. 18*).—A circular giving a list of plants, plant products, nursery stocks, and animals and insects upon which restrictions of movement have been placed in Porto Rico. The texts of the regulatory laws and of certain Federal quarantine acts are included.

Spray calendar, W. E. Britton and G. P. Clinton (*Connecticut State Sta. Bul. 224 (1921), pp. 67–110, figs. 99*).—A revision of Bulletin 199 of the station (E. S. R., 38, p. 843).

Handling spinach for long-distance shipment, V. W. Ridley (*U. S. Dept. Agr., Farmers' Bul. 1189 (1921), pp. 15, figs. 9*).—A contribution from the Bureau of Markets presenting a study in the proper handling of spinach for shipment to distant markets, a preliminary report upon which has been already noted (E. S. R., 43, p. 144).

Harvesting operations are a factor, in that bruised plants are more susceptible to decay than carefully handler material. Tests indicated the inadvis-

ability of washing spinach preparatory to shipments, except when material is unsightly. In preparing the car for spinach it is advised to place a false bottom over the car floor, rendering possible the circulation of the cooled air. Diagrams are included illustrating the proper method of placing baskets.

In 1918 investigations were undertaken to determine the factors involved in the transportation of spinach. A soft rot, belonging to the group of which *Bacillus carotovorus* is a typical example, was found by J. C. Walker, of the Bureau of Plant Industry to be the principal cause of decay. Under favorable conditions this decay can render spinach worthless shortly after removal from the car.

Icing within the package, in addition to the car icing, eliminated decay. Baskets of spinach in which half the ice was placed in the center of the spinach and the remainder on the top, just below the cover, kept in better condition than baskets with all the ice in the center. Diagrams are included showing the temperature of spinach obtained during a test trip from Austin, Tex., to Chicago. The baskets were iced in the center only. The spinach below the ice held at 34 to 35°, above the ice at a minimum of 42° F. Temperatures taken at different locations in the car indicated a uniform rate of cooling but a consistently higher temperature at higher elevation within the car.

[Pomological investigations at the Southern Oregon Branch Station, Talent] (*Oregon Sta. Rpt. 1919–20, pp. 76–78*).—Fertilizer experiments on bearing apple, pear, and peach trees continue to show no benefit from potash and very little from phosphorus, while nitrogen has in all cases increased the yield, size of fruit, and vigor of the tree (E. S. R., 43, p. 145).

Blight resistance studies with pear have been in progress since 1915. A large collection of pears has been assembled, together with many Pyrus species from throughout the world. Studies of the various species have revealed one almost totally immune and three fairly immune species.

The distribution of northwestern boxed apples, C. W. KITCHEN, E. M. SEIFERT, JR., and M. B. HALL (*U. S. Dept. Agr. Bul. 935 (1921), pp. 27, pls. 7*).—A contribution from the Bureau of Markets relevant to the distribution, prices, and other factors influencing the marketing of boxed apples from Washington, Oregon, Idaho, and Montana. The investigations cover the period of 1915–16 to 1919–20. Production, preparation for market, transportation and storage facilities, rate of movement, marketing methods, distribution, export shipments, and f. o. b. prices are considered. Statistical data, on which the discussions are based, are included in the appendix, graphically illustrated by means of charts, diagrams, and outline maps.

Manual of tropical and subtropical fruits, W. POPENOE (*New York: Macmillan Co., 1920, pp. XV+474, pls. 24, figs. 62*).—A popular presentation of information concerning many of the important fruits of the tropical and subtropical regions. The banana, coconut, pineapple, citrus fruits, olive, and fig are excepted on account of the abundance of other available literature. Much valuable information is given relative to the history, literature, propagation, and culture requirements.

Roses (*Missouri Bot. Gard. Bul., 9 (1921), No. 3, pp. 29–37, pls. 3*).—A popular article on rose culture to which is appended an alphabetically arranged report on the behavior of roses grown in the Missouri Botanical Garden in 1920.

FORESTRY.

Black walnut: Its growth and management, F. S. BAKER (*U. S. Dept. Agr. Bul. 933 (1921), pp. 43, pls. 7, figs. 4*).—A contribution from the Forest Service, extending information previously noted (E. S. R., 44, p. 537). The subject is

treated under the following headings: Distribution of walnut, supply, description of the tree, silvical characteristics, growth of individual trees, growth of stands, measuring logs and estimating standing timber, walnut plantations, and establishing walnut plantations. The discussion is amplified by tables.

Farm forestry in the shortleaf pine section of east Texas, G. D. Marckworth (*Tex. State Forester Bul. 10* [*1920*], *pp. 19, figs. 8*).—This bulletin presents in popular form a discussion of the present status of the farm woodlands in east Texas, with instructions and suggestions for their development on an economic forestry basis. Careful thinning, necessity of fire protection, determination of stock on hand, marketing, stumpage value of shortleaf pine, increase in values, and use of wood on the farm are considered.

Thee planting by farmers for fuel, fence posts, and shelter, E. O. Siecke and L. Wyman (*Tex. State Forester Bul. 13* (*1920*), *pp. 23, figs. 10*).—A popular treatise on tree planting for the nonwooded farms of Texas. The authors point out the value of windbreaks in their beneficial influence on crops, in lessening erosion, and in mitigating the severity of sandstorms. Instructions are presented relative to the establishment and maintenance of windbreaks and groves with reference to location, selection and arrangement of species, and renewal.

Some observations on the forest problems of Hawaii, H. I. Lyon (*Hawaii Sugar Planters Assoc. Proc.. 39* (*1919*), *pp. 14–34, figs. 6*).—The importance of reforestation in Hawaii is emphasized. Native species are unable to withstand the depredation of cattle and invading Hilo grass, and as a consequence the watersheds are in danger of becoming depleted of trees. The lack of vitality of native species seems due to the isolation of the islands, thus shutting off natural plant immigration.

The karaka, loquat, and Japanese plum are mentioned as desirable self-propagating introduced species. *Ficus elastica* is exceptionally satisfactory because of its vigorous soil-binding roots, ability to withstand cattle injury, and comparative freedom from insects and fungus pests. Unfortunately, none of the Ficus species in Hawaii can reproduce naturally due to absence of pollinating insects. Three hundred species of oriental trees and plants have been recently introduced in the hope of securing useful materials. A discussion of the subject is included.

Reports of the forest branch of the Department of Lands, British Columbia, for the years ending December 31, 1919 and 1920, M. A. Grainger, P. Z. Caverhill, et al. (*Brit. Columbia Forest Branch Dept. Lands Rpts., 1919, pp. 32, figs. 3; 1920, pp. 38, figs. 4*).—The usual reports of the activities of the forest service relative to yields of forest products, forest fires and their prevention, revenues and expenditures, etc., for the calendar year.

Progress report of forest research work in India for the year 1919–20 (*Forest Research Inst., Dehra Dun. Prog. Rpt., 1919–20, pp.* [*III*]+*56, pls. 4*).—The usual progress report (E. S. R., 42, p. 446) relative to investigations dealing with silviculture, forest working plans, forest botany, forest economy, forest zoology, forest chemistry, and forest publications. Appended to the report is an administration report, and a list of forest publications issued since the establishment of the Forest Research Institute.

Annual progress report upon State forest administration in South Australia for the year 1919–20, W. Gill (*So. Aust. State Forest Admin. Ann. Rpt. 1919–20, pp. 12, pls. 10*).—This is the usual annual report upon the activities of the Woods and Forests Department for the year ended June 30, 1920. Data are included relative to the alterations in forest areas, planting operations, distributions of trees, revenues, expenditures, etc.

DISEASES OF PLANTS.

[Investigations in plant diseases] (*Illinois Sta. Rpt. 1919, pp. 16, 17*).—Field work in experimental spraying for the control of the apple blotch (*Phyllosticta solitaria*) is reported upon. In most of the experiments it has been found that infection takes place earlier than 3 weeks after the fall of the petals, with practically no infection later than 7 weeks after the petals fall.

In attempts to control collar rot of Grimes apples in western Illinois by bridge grafting, it was found that this method was not to be recommended when trees had begun to show a yellow, sickly foliage, but that the method might be used with advantage if the diseased areas on the trunk were not large. Several years of investigation on the cause of the collar rot have thus far failed to reveal any definite organism, and it is believed that it is due to some physiological condition.

Investigations on the control of the blister canker are said to have shown that cutting out the diseased areas will not eliminate the disease. The fungus is active in the wood for several feet in both directions from the external canker, and new cankers appear about the exsected region.

Raspberry anthracnose is reported to be held in check by four applications of lime sulphur, (1) before the buds open, (2) when the young shoots are from 4 to 6 in. high, (3) when the shoots are from 8 to 10 in. high, and (4) just before the plants come into bloom.

A brief note is given on the leaf spot of strawberry, a previous account of which has been noted (E. S. R., 43, p. 753).

Report of the department of botany and plant pathology (*Oregon Sta. Crop Pest and Hort. Rpt. 3 (1915–1920), pp. 131–202, figs. 34*).—Progress reports are given of a number of investigations conducted under the Oregon Crop Pest and Horticultural Law.

Wood decay in orchard trees in Oregon, S. M. Zeller (pp. 132–138).—Attention is called to the necessity of preventing decay in orchard trees due to such organisms as *Irpex lacteus*, *Polystictus versicolor*, *P. hirsutus*, *Trametes carnea*, *Lenzites sepiaria*, *Fomes pinicola*, *Stereum hirsutum*, etc. Careful attention to pruning injuries to trees is said to reduce the liability to wood decay. Investigations were made of a number of antiseptics for treating wounds, and Bordeaux paste was found to be an effective air-porous covering for wounds if applied each fall. More permanence may be given the treatment if copper nails or tacks are used to supplement the application of Bordeaux paste as recommended by Volck.[1] A test of this method showed that it was of considerable merit, particularly for the treatment of large wounds. Bordeaux paste used alone is considered efficient for small wounds.

A serious nematode disease of strawberry and clover in Oregon, M. B McKay (pp. 139–144).—The occurrence of *Tylenchus dipsaci* was reported on strawberries in Oregon in 1916 and clover in 1915, and since that time this pest has been found on the same plants in a number of localities. For its control the proper rotations of the land with nonsusceptible crops is recommended.

Peach leaf curl control, H. P. Barss (pp. 145–151).—For the control of peach leaf curl the author recommends the use of Bordeaux mixture 6:6:50 applied as a spray any time between the first of December and the first part of February.

Gooseberry mildew control, C. E. Owens (pp. 152–155).—A description is given of the gooseberry mildew due to *Sphærotheca mors-uvæ*. As a result of

[1] Calif. Hort. Comn. Mo. Bul., 6(1917), No. 3–4, pp. 80–89.

the experiments carried on by the station, the best control was obtained where lime sulphur was used, the applications being made when the leaves were beginning to emerge from the buds, followed by other applications just before blossoming and just after blossoming. Dusting with a high-grade, specially prepared, dusting sulphur is considered a promising method of control which would probably prove effective during warm weather.

Cylindrosporium leaf spot of prune and cherry, H. P. Barss (pp. 156–158).—A description is given of leaf spot of prunes and cherries due to *Coccomyces* sp. For the control of this disease experiments conducted in Oregon have shown that thorough spraying with Bordeaux mixture 4:4:50, the first application being made about May 1, and the spraying repeated at intervals of 3 or 4 weeks until dry summer weather becomes established, gives satisfactory results. In addition, it is recommended that the old leaves be disposed of as completely as possible.

Physiological disorders of developing fruits, H. P. Barss (pp. 159–166).—Descriptions are given of a number of troubles of fruits and other crops which are considered due to a disturbance of the water balance of the trees as a consequence of the inability of the roots to supply as much moisture as the foliage and fruit demand. Among the diseases described are apple blister, drought spot, cork, punk, hollow apple, bitter pit or Baldwin spot, cork and black end of pears, gum spot or drought spot of prunes, internal browning of prunes, internal browning of potatoes, etc. For the control of these troubles it is believed that the introduction of methods whereby moderate irrigation could be practiced would prove highly profitable.

Notes on tests with fungicides, H. P. Barss and W. A. Smart (pp. 167–171).—The results are given of preliminary tests of fungicides for the control of the apple-tree anthracnose, in which various strengths of Bordeaux mixture, Burgundy mixture, copper soap, and magnesium-Bordeaux mixture were employed. The applications were made in connection with the last codling-moth spray, and when the fruit was examined considerable injury was observed. This was found to be due to the reddening of the lenticels when they split open. So far as the control of the anthracnose is concerned, the experiments were not considered very satisfactory. The authors recommend the addition of ⅛ oz. of granulated sugar for every pound of copper sulphate used in the preparation of Bordeaux mixture in order to stabilize the fungicide. It is recommended that there be added to the lime sulphur iron sulphate at the rate of ½ lb. to each gallon of concentrated lime sulphur. When added to the fungicide the iron changes the color of the mixture to black, making it possible to observe the effect of the application.

Comparisons were made of dry lime sulphur and ordinary liquid lime sulphur for the control of peach leaf curl and other diseases, with the result that regular lime sulphur gave the better results. Dilute lime sulphur gave the poorest control, and dry lime sulphur was distinctly inferior to that made by the regular formula.

Control of moss and lichens in the orchard, W. A. Smart (pp. 172, 173).—Spraying fruit and nut trees with a winter spray of Bordeaux mixture 6:6:50 is recommended for the control of lichens and mosses in fruit trees. Lime sulphur 1:8, it is said, will accomplish the same result, although the effect may not be quite so lasting.

Western yellow tomato blight, M. B. McKay (pp. 174–178).—A description is given of a disease of tomatoes which appears to be largely due to a species of Fusarium, although some cases have been found in which Rhizoctonia has attacked the plants. Definite means of control have not been determined, but

it is stated that some growers have had considerable success in holding the disease in check by the use of windbreaks. Where the soil of the seed bed is suspected of being infected with the disease, it is recommended that it be sterilized by steam or boiling water.

Mosaic disease of tomatoes, M. B. McKay (pp. 179–184).—This disease of tomatoes was first noticed in the summer of 1920, and a survey of the State showed that it was present in a number of localities. The cause of the disease is unknown, but it is said to be infectious and contagious. Methods of control are suggested which indicate that the disease is probably carried over in the soil, particularly in seed beds, and may be spread by insects, especially by plant lice.

Blossom-end rot of tomatoes, M. B. McKay (pp. 185, 186).—This disease of tomatoes is said to be rather common in Oregon, particularly during or following a period of dry weather, and it is considered to be identical with a disease previously described (E. S. R., 26, p. 648). The only practical method of control, in the author's opinion, appears to be the properly balanced use of soil moisture, fertilizers, and cultural methods, so as to avoid the development of harmful compounds in the soil and insure conditions such that proper growth produced early in the season can be maintained through to maturity.

Onion smut control, H. P. Barss (pp. 187–191).—For the control of the onion smut due to *Urocystis cepulæ*, treatment of onion seed when planted by dripping formaldehyde in the furrows is recommended.

Bean blight and bean mosaic, H. P. Barss (pp. 192–196).—Descriptions are given of bean blight, due to *Bacterium phaseoli*, and bean mosaic, both of which are said to occur in Oregon, and in some instances to cause considerable damage. For the prevention of these diseases the planting of resistant varieties or of seed grown in regions where the disease is not prevalent is recommended.

Grain smuts and their control, H. P. Barss (pp. 197–202).—Popular descriptions are given of corn smut, the loose smuts of wheat and barley, oat smuts, the bunt or stinking smut of wheat, and the covered smut of barley. The various sources of infection are pointed out, and the use of resistant varieties wherever available and the chemical treatment of seed, etc., by formaldehyde or copper sulphate solutions, are recommended.

Department of botany and plant pathology (*Oregon Sta. Rpt. 1919–20, pp. 53–59*).—Brief summary reports are given of investigations on potato diseases, diseases of orchard trees (noted on page 839), cereal diseases, onion smut control, and tomato diseases, and of spraying experiments.

Under the report on the potato disease investigations, it is stated that information has been obtained which has much practical application in the selection of seed potatoes to avoid wilt infection. For the treatment of tuber-borne diseases, it is said that soaking tubers in corrosive sublimate has proved satisfactory.

The spraying investigations conducted by the station are said to indicate that Bordeaux mixture is superior to lime-sulphur solution or dry lime sulphur as a winter spray for peach leaf curl control. Bordeaux mixture is also claimed to be more permanent than sulphur sprays for moss destruction, although not quite so rapid in its action as lime sulphur plus lye. For the prevention of a number of diseases, dry lime sulphur was successfully substituted for the usual liquid lime sulphur.

More than 1,000 varieties of wheat were tested for resistance to stinking smut. Several highly resistant ones were observed, and at least one variety has proved immune to disease. In studies of the effect of seed treatment on the physiology of the grain, it was found that formaldehyde would enter the

seed wheat and that there was an apparent retarding effect on the respiration of the seed, varying with the concentration of the solution. Preliminary tests also indicated reduction in respiratory activity in growing seedlings due to previous treatment of the seed with formaldehyde. In studying methods of seed treatment it was found that there was a high percentage of injury to seed coats of wheat from the usual thrashing operations. Injury to stand was found to result not only from treatment methods but also from the attacks of fungi. The use of a lime bath following the copper-sulphate treatment was found to reduce very greatly the injury due to the solution. It is claimed that the formaldehyde treatment is best employed when the soil and temperature conditions are favorable for prompt and vigorous germination.

The presence of stripe rust of cereals and grasses was reported and about 300 varieties of wheat, as well as other cereals, have been tested for susceptibility to this disease.

Mycological and phytopathological notes, J. Weese (*Ber. Deut. Bot. Gesell.*, *37 (1919), No 10, pp. 520–527, pl. 1*).—The first part of this article deals with the canker fungus (*Nectria ditissima*) of fruit and deciduous forest trees, the second chiefly with injury to orchids by species of the same genus.

Plant diseases, T. G. B. Osborn (*So. Aust. Min. Agr. Rpt.*, *1919, pp. 30, 31*).—This report includes notes on wheat root gall (*Heterodera radicicola*), potato wilt (*Verticillium* sp.), potato injury due to *Armillaria mellea* and *Fusarium* sp., citrus die-back bark disease (*Diplodia citricola*), and citrus twig die-back and fruit spots (*Phoma omnivora* and *Diplodia* sp.). Apple mildew is of infrequent occurrence. Black spot fungus of loquats (*Fusicladium eriobotryæ*) has been observed, also a number of minor diseases of stone fruits, including shot hole of almonds, peaches, and apricots due to *Clasterosporium carpophilum*, which appears to be the most generally distributed of the shot-hole fungi in this State. A peach fruit rot (*Fusarium* sp.) is associated with split stone. Cabbages and cauliflowers showed blackleg (*Phoma lingam*). Onion mildew (*Peronospora schleideniana*) persists in some gardens. A pea wilt is associated with *Fusarium* sp. Ascochyta leaf blotch and a bacteriosis of peas were also observed.

Variations in Colletotrichum glœosporioides, O. F. Burger (*Jour. Agr. Research* [*U. S.*], *20 (1921), No. 9, pp. 723–736 pl. 1, figs. 2*).—In a contribution from the California Experiment Station, the author describes variations observed in cultures of *C. glœosporioides*. He claims that this species is a polymorphic one made up of a number of strains, which, when grown on artificial media, give distinct cultural characteristics. Each strain is affected by its environment, and induced variations may be more or less permanent. There are said to occur mutations in culture which resemble the strains isolated from the natural environment.

Observations on yellow rust outbreaks, W. Lang (In *Festschrift zur Feier des 100 Jährigen Bestehens der Kgl. Württ. Landwirtschaftlichen Hochschule Hohenheim. Stuttgart: Eugen Ulmer, 1918, pp. 84–101*).—This account of recent outbreaks of cereal yellow rust (*Puccinia glumarum*) deals with overwintering, spring spore production, weather, and other conditions, as influencing loss due to rust.

Cereal stripe disease (helminthosporiose), G. Köck (*Nachr. Deut. Landw. Gesell. Österr.*, *n. ser.*, *3 (1919), No 34, pp. 289, 290*).—This brief account regarding oat stripe disease (*Helminthosporium avenæ*) and barley stripe (*H. gramineum* and *H. teres*) states that especially in case of barley the disease is increasing in severity, but that thorough seed treatment with 0.1 per cent formaldehyde for 10 minutes or 0.5 per cent Uspulün for 2 hours is to be unconditionally recommended.

The inheritance of resistance to bunt or stinking smut of wheat, E. F. Gaines (*Jour. Amer. Soc. Agron., 12 (1920), No. 4, pp. 124–132*).—The material presented in this paper concerns the bunt resistance at the Washington Experiment Station of three wheats, Turkey (Washington 326), Hybrid 128 (Washington 592), and Florence (Washington 634), and the resistance of the F_2 and F_3 as well as selections in the F_4 generation of two crosses, Turkey × Hybrid 128 and Turkey × Florence. The comparative resistance of 13 different varieties under conditions of maximum infection has been described in an earlier article (E. S. R., 40, p. 346). The results are presented in tabular form on a comparative basis with discussion and interpretation.

The wide differences in the amount of bunt produced in the F_3 (under the conditions of infection and time and method of sowing, which were as simple as possible under field conditions) in comparison with the constancy of the performance of the parent varieties are considered to warrant the conclusions that bunt resistance in wheat is not a simple Mendelian unit character. Resistance, if Mendelian, is composed of multiple factors, for a continuous series ranging from complete immunity to complete susceptibility has been obtained. Different wheat varieties possess different kinds of resistance, and linkage between resistance and morphological characteristics is not sufficient to prevent the selection of a resistant strain of any morphological type desired.

Stinking smut of wheat, Zade (*Deut. Landw. Presse, 47 (1920), Nos. 27 pp. 204, 205; 28–29, pp. 210, 211*).—A method, which is described, of treating seed wheat with formalin to prevent stinking smut was tried and found to be effective.

An obscure disease in wheat, J. T. Pridham (*Agr. Gaz. N. S. Wales, 31 (1920), No. 4, pp. 229–231 figs. 2*).—At Cowra and other districts, a condition in wheat supposed to be due to a disease of unknown causation was noted as far back as 1911. Iron sulphate is being tested in this connection.

Occurrence and control of blackleg of cabbage, J. C. Walker (*Abs. in Phytopathology, 10 (1920), No. 1, p. 64*).—The author reports that on part of a seed bed sown at Madison, Wis., with infected seed and protected from rain, 0.5 per cent of the plants were infected after three months, while that portion of the bed exposed to natural rainfall showed 29 per cent, and when frequently sprinkled, 39 per cent of diseased plants. Seed from the same lot sown at La Conner, Wash., where dry weather prevailed, showed no disease after seven weeks. Rainy periods are considered essential for the dissemination of the fungus from primary centers. The fungus is not entirely eradicated from infected seeds by treatment with mercuric chlorid, formaldehyde, water, or dry heat.

Phoma root rot of celery, C. W. Bennett (*Abs. in Phytopathology, 10 (1920), No. 1, p. 67*).—A root rot of celery, caused by *Phoma apiicola*, is reported as doing considerable damage in Michigan. The disease attacks the roots and bases of the plants, resulting in a rotting off of the roots near the crown or in the production of large black areas just beneath the surface of the soil. Moisture is considered the controlling factor in the restriction of the organism to the underground parts, and a lack of oxygen is believed important in keeping the roots, which are deep in the soil, free from the disease.

Another conidial Sclerospora of Philippine maize, W. H. Weston, Jr. (*Jour. Agr. Research [U. S.], 20 (1921), No. 9, p. 669–684, pls. 4, fig. 1*).—The author, in a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, reports the occurrence of a second species of Sclerospora occurring on maize in the Philippine Islands. This species, which is described as *S. spontanea* n. sp., is said to occur on several of the southern islands, where it was found on the wild grass *Saccharum spontaneum*, on sugar cane,

and on maize. Comparative studies were made between this species and *S. philippinensis*, previously described (E. S. R., 43, p. 545). Although morphologically the two species were found to differ very materially, yet physiologically, in general effect in the field and on the individual plant, no distinction could be recognized.

The discovery of *S. spontanea* on wild *Saccharum spontaneum* is, the author believes, the first record of the occurrence of a conidial Sclerospora on a wild host in the Orient. This, together with other data, is believed to indicate that wild grasses are the natural hosts of these oriental downy mildews, from which they pass to susceptible crops such as maize.

Eggplant blight, C. W. Edgerton and C. C. Moreland (*Louisiana Sta. Bul. 178 (1921), pp. 3–44, figs. 18*).—The authors describe investigations on the disease of eggplant due to *Phomopsis vexans*. This disease, commonly known as eggplant blight, is said to usually reduce the yield of eggplants in Louisiana at least one-half. The fungus attacks all parts of the eggplant above ground and at all stages of development. The disease is claimed to be carried over the winter on and in the seed. No ascogenous stage has been definitely connected with *P. vexans*, although a species of Diaporthe is often found on the dead stems. The authors found that the disease was easily produced by inoculation, the fungus being able to penetrate the uninjured tissues of the host. The period of incubation is usually from 7 to 9 days. All inoculation experiments on plants other than eggplant have thus far been unsuccessful.

In controlling or checking the disease the authors recommend the use of clean seed and rotation, burning of all plants at the end of the season, treatment of the seed before planting with a 1:300 formaldehyde solution, the use of strong plants, and their protection by spraying with a 4:4:50 Bordeaux mixture. Spraying when properly done, it is claimed, will check the disease, but it is questionable whether it will be found profitable. All varieties of eggplant are said not to show equal susceptibility to the disease.

Flax canker, a nonparasitic disease, C. S. Reddy and W. E. Brentzel (*Abs. in Phytopathology, 10 (1920) No. 1, pp. 66, 67*).—A description is given of a type of flax canker which is said to occur somewhat uniformly in the semiarid Northwest and to cause a marked loss in flax production. No parasitic organism has been found associated with this type of canker, and the evidence is considered to show that high temperature at the soil line during the early growth of the plant is the chief cause of the trouble.

Onion smudge, J. C. Walker (*Jour. Agr. Research [U. S.], 20 (1921), No. 9, pp. 685–722, pls. 6, figs. 10*).—An account is given of investigations of onion smudge due to *Colletotrichum circinans*, the investigations being carried on cooperatively between the University of Wisconsin and the Bureau of Plant Industry, U. S. Department of Agriculture.

This disease is said to be one of the most common ones attacking white onion sets in Wisconsin and Illinois, and also to occur on the shallot and leek, but not on garlic. The disease is said to be confined to the scales and neck of the bulb, where is causes dark spots. On colored varieties the disease is confined to the unpigmented portions of the outer scales of the neck of the bulb.

A detailed description of the morphology of the causal organism is given. The author considers the proof incomplete of the occurrence of an ascigerous form, *Cleistothecopsis circinans*, as described by Stevens and True (E. S. R., 41, p. 246).

The fungus is said to overwinter as stromata in infected scales, and infection occurs at or above 10° C. (50° F.), with an optimum of about 26°. Conidia are produced abundantly under moist conditions and at temperatures between

20 and 30°. The disease is said to develop most rapidly in the field when the mean soil temperature range lies between 20 and 30° and is accompanied by abundant rainfall. Extremely hot, dry weather checks the progress of the disease.

Smudge is said to promote premature sprouting and to increase the shrinkage of sets in storage. The disease may be spread from bulb to bulb in the crate under moist conditions, but in proper storage this factor is negligible. The more important measures for the control of smudge are said to be protection of the harvested crop from rain, rapid and thorough curing, and well-ventilated storage at about 33 to 36° F.

Pythium as a causal factor in pea blight, F. R. JONES (*Abs. in Phytopathology, 10 (1920), No. 1, p. 67*).—The term pea blight as used by canners is said to refer to several diseases caused by parasites, among them *Rhizoctonia solani*, a species of Fusarium, and Pythium (probably *P. debaryanum*). Under the conditions prevailing in Wisconsin, Illinois, and Michigan in 1919, Pythium is said to have been the most important cause of the blight.

Degeneration in potato, C. PERRET (*Vie Agr. et Rurale, 9 (1920), No. 33, pp. 105–110, figs. 2*).—A discussion is given based on the symptoms of the principal forms of degeneracy in potato.

The mosaic disease of the Solanaceæ, its relation to the phloem necrosis, and its effect upon potato culture, H. M. QUANJER (*Phytopathology, 10 (1920), No. 1, pp. 35–47, figs. 14*).—The author claims that the previous conception of leaf curl of potatoes includes two distinct diseases, leaf roll or phloem necrosis and leaf curl, curly dwarf, or mosaic, all of which are considered different manifestations of the same disease. The first disease is contagious, pseudohereditary, and characterized by necrosis of the phloem strands. True leaf curl or mosaic is also contagious, and plants that show the faintest symptoms of curly dwarf or mosaic may transmit this tendency to later generations, where the symptoms may become intensified. Both phloem necrosis and mosaic may be transmitted by grafting, but the chief means of infection is said to be through the occurrence of infected plants in the field. The author's experiments are held to show the transmission of the diseases whenever the roots of plants intertwine. The contamination can also pass through the soil, and the author considers it doubtful whether wounds are necessary for infection.

The similarity of mosaic diseases of other plants is noted, and the author seems inclined to the view that they are due to a parasitic agent as yet undetermined.

Varietal differences are noted in respect to resistance to these diseases, and it is claimed that attention should be given this fact in breeding experiments with potatoes.

Phloem necrosis in potato, F. ESMARCH (*Ber. Deut. Bot. Gesell., 37 (1919), No. 9, pp. 463–470*).—This is largely an account of the studies and views of previous contributors on this subject.

Stem necrosis in potatoes affected with leaf roll, E. FOËX (*Compt. Rend. Acad. Sci. [Paris], 170 (1920), No. 22, pp. 1336–1339*).—Leptonecrosis of potato stems is here described as a process of pectic degeneration tending toward a sort of gummosis.

Effect of straw mulch on potato leaf roll, W. O. GLOYER (*Abs. in Phytopathology, 10 (1920), No. 1, p. 60*).—As a result of mulching potatoes, the author concludes that mulching does not overcome the infectious nature of the disease, and that in badly diseased fields even tubers of the healthy appearing and high yielding plants are unsafe for seed purposes.

Spraying of potatoes in the Netherlands, J. WESTERDIJK (*Jahresber. Ver. Angew. Bot., 16 (1918), No. 3, pp. 132–138*).—An account is given of crop returns

and other economic bearings of the employment of spraying against *Phytophthora infestans* in different portions of the Netherlands.

Studies on varietal resistance and susceptibility to bacterial blight of the soy bean, C. M. Woodworth and F. C. Brown (*Abs. in Phytopathology, 10 (1920), No. 1, p. 68*).—Field experiments at the University of Wisconsin are said to indicate that soy bean varieties vary greatly in their relative susceptibility to the bacterial blight. Of 47 varieties grown in 1918, about half were completely resistant and the other half ranged from complete susceptibility to partial resistance.

Yellow-stripe disease investigations (*Jour. Dept. Agr. Porto Rico, 3 (1919), No. 4, pp. 151, pls. 6, figs. 12*).—This is a progress report of investigations noted below.

The year's experience with sugar cane mosaic or yellow-stripe disease, F. S. Earle (pp. 3–33).—This report covers the period following that reported on by Stevenson (E. S. R., 42, p. 744) regarding sugar cane mosaic or yellow stripe. The subjects dealt with include a field survey, eradication methods, cultivation methods for severely infected ground, effect on sugar cane production, infection methods, resistance and immunity, an insect survey, experiments with caged insects as regards carrying the disease, morphological, histological, and cytological studies of cane, search for a causal organism, chemical studies of diseased cane, soil studies, and relationship with other diseases.

The mottling disease of cane and the sugar production of Porto Rico, C. A. Figueroa (pp. 35–41).—This includes an account of the regional prevalence of the cane mottling disease in Porto Rico, and of corresponding reductions in the sugar yield. Other conditions affecting sugar production are included.

The absorption spectrum of the chlorophyll in yellow striped sugar cane, E. D. Colón (pp. 43–46).—This report, which is to be continued, is held to warrant the belief that the disappearance of the pigment in yellow stripe is not primarily due to a decomposition of the chlorophyll as such.

Has yellow stripe or mottling disease any effect on the sugar content of cane juice? F. A. López Domínguez (pp 47–64).—Parallel analyses of healthy canes, canes with mottled leaves, and canes with leaves mottled and stalks affected by the disease but not cracked, as conducted during the spring of 1919, failed to show any difference in the sugar content of the canes compared, which were of the Rayada variety. A slight increase in acidity was observed on the part of the cankered canes.

A second series of parallel analyses, using Kavangire cane and substituting canes with the stalks cracked for the cankered canes with the stalks whole, revealed a higher acidity, lower sucrose content, and in the cases where tests were made, a higher content of reducing sugars in the cankered, cracked canes.

The general conclusion reached is that the mottling or yellow-stripe disease does not materially affect the sugar content of canes attacked, except in an indirect way, when the stalks become cracked as a result of the drying up of the stalk. In this case the exposure of the inner tissues brings about fermentation with the subsequent increase of acidity, inversion, and loss of sucrose. A tendency is observed of diseased canes to show an increase in acid content, but this increase is not serious enough to cause inversion, except in very acute stages of the disease, and after cracking has occurred.

Infection and nature of the yellow-stripe disease of cane (mosaic, mottling, etc.), J. Matz (pp. 65–82).—This is a somewhat detailed summary of experiments and histological studies carried on during a period of 12 months, subsequent to December, 1918.

From a study of the internal structure of cankered cane, it is considered that actual deterioration and breaking down of cells in the interior of cane occur

in an advanced stage of the yellow-stripe disease. This effect is thought to be due to the destructive action of the infective substance of yellow-stripe disease, since there appears to be no connection between these interior sick cells and other outside mechanical or organized agencies. A substance resembling a Plasmodium, in some of the interior cells, was found to be constantly associated with yellow-striped cane in an advanced stage of disease.

Insects and mottling disease, E. G. Smyth (pp. 83-116).—Failure of ordinary means of dispersion to account for the rapid spread of the cane mottling disease has led to a belief that the disease may be carried by insects, probably sucking rather than chewing insects. The only insect yet observed which appears to satisfy all conditions, on the south coast at least, is the yellow cane thrips (*Frankliniella* sp.). From the large number of experimental tests made in insect transmission, only four successful inoculations resulted, and these were from different species of insects. It seems probable that inoculation of a healthy cane plant with mottling disease requires the plant to be in a condition of rapid growth. This may account, in part, for failure of attempts to inoculate through the medium of insects. There still remains to be investigated the question as to the infective principle of the disease being carried by the insect for some length of time and undergoing a cyclic change within the insect body, or of its being transmitted to the young through the egg, before it becomes pathogenic to the plant host, through the bite of the insect.

An annotated bibliography of Porto Rican cane insects, E. G. Smyth (pp. 117–134).—This includes about 136 references, arranged chronologically.

List of the insect and mite pests of sugar cane in Porto Rico, E. G. Smyth (pp. 135–150).—This includes 65 insects that have been found repeatedly feeding upon the cane plant (*Saccharum officinarum*).

The mosaic or matizado disease of sugar cane, F. S. Earle (*Porto Rico Dept. Agr. and Labor Sta. Circ. 22 (1920), Spanish ed., pp. 3–9*).—This is a popular account in Spanish of investigations which have been more extensively reported upon in the publication noted above.

The relation of soil temperature to the development of the tomato Fusarium wilt, E. E. Clayton (*Abs. in Phythopathology, 10 (1920), No. 1, pp. 63, 64*).—The growth reactions of the fungus and normal plant were determined for a wide temperature range. The optimum, for the growth of the fungus was found to be about 28° C. (82.4° F.), with a minimum of 9 to 10° and a maximum of 37°. The optimum soil temperature for the growth of the normal tomato plant was found to lie between 25 and 30°, with the maximum a little above 35° and the minimum a little below 12°. The optimum soil temperature for the development of the disease proved to be about 28°. The disease rarely occurred at temperatures lower than 22° or higher than 32°.

The Alternaria fruit rot and Rhizoctonia stem rot of tomatoes, M. T. Cook (*Abs. in Phytopathology, 10 (1920), No. 1, p. 59*).—The author claims that this rot presents three forms, following the infection of cracked fruit, following the infection of sunburned fruit, and nail-head spot on green fruit. Most attention was paid to the sunburn phase of the disease, which is due to a loss of foliage following attacks of *Septoria lycopersici*.

The stem rot due to Rhizoctonia is said to have been very prevalent in the southern part of New Jersey in 1919.

Apple blister canker, W. O. Gloyer (*Abs. in Phytopathology, 10 (1920), No. 1, p. 58*).—As a result of seven years' study of blister canker, the author concludes that the canker caused by *Nummularia discreta* is not so important economically in New York as in the Middle West. The fungus is more actively parasitic on Sorbus than on Malus. Forms varying in pathogenicity and cultural characters sufficiently to be called varieties or strains are produced by

varying the substratum on which the parasite grows. The fungus may be active in the wood and yet show little canker formation. When present in the wood the fungus is one cause of slime flux. Cankers may enlarge at any time between early spring and late autumn. They increase slowly during periods of drought and become more active after rains following drought. The use of shellac followed by coal tar was found to be most satisfactory as a covering for pruning wounds. The covering is not considered the controlling factor in the healing of a cankered wound. The physiological condition of the host plant determines the activity of the parasite. Parasitism is complex and can not be measured in terms of percentage of water content of the wood.

A preliminary report on apple scab and its control in Wisconsin, G. W. Keitt (*Abs. in Phytopathology, 10 (1920), No. 1, p. 58*).—The author reports observations on the discharge of ascospores of *Venturia inæqualis* in 1919 at Madison and Sturgeon Bay, Wis. At Madison the discharge began on April 20 and ended June 7. At Sturgeon Bay the first ascospore discharge was noted May 15, the last June 16. Lime sulphur and Bordeaux mixture failed to control scab satisfactorily at Sturgeon Bay when applied according to the standard four-spray schedule. However, the addition to this schedule of an application on May 16, soon after the blossom buds became exposed in the clusters, led to excellent control.

Disinfectants for blight control work (*Oregon Sta. Rpt. 1919–20, p. 78*).—Attention is called to the inefficiency of corrosive sublimate for the disinfection of wounds in pear and apple trees from which pear blight had been cut. Cyanid of mercury when used as a disinfectant was entirely effective.

Pear canker, V. Enfer (*Rev. Hort. [Paris], 91 (1919), No. 13, pp. 217, 218*).—Attention has been attracted for more than 10 years to the presence on pears of cankers analogous to those on apple. Directions are given for the preparation and use of a remedial spray solution containing about 50 per cent iron sulphate and 1 per cent sulphuric acid.

Relative prevalence of fungi causing rots of cranberries at different periods during the storage season, B. A. Rudolph and H. J. Franklin (*Massachusetts Sta. Bul. 198 (1920), pp. 88–92, figs. 2*).—The authors summarize studies on cranberry rots, some of the results which have already been noted (E. S. R., 39, pp. 55, 749).

In the present paper attention is given principally to the succession among the fungi causing decay during the storage period. The most important causes of decay of cranberries in storage are said to be *Guignardia vaccinii* (early rot), *Glomerella cingulata vaccinii* (bitter rot), *Fusicoccum putrefaciens* (end rot), *Ceuthospora lunata* (black rot), *Sporonema oxycocci* (ripe rot), *Penicillium* spp. (soft rot), and *Phomopsis* sp.

The studies were made on Early Blacks and Howes, and in 1916 both Phomopsis and Glomerella were most abundant early in the storage season, gradually becoming less important. Fusicoccum was relatively scarce early in the season, but became very abundant as the season advanced, so that after November 1 the rot caused by this fungus was more important than all the other rots combined. In 1917 Sporonema was given as the least important cause of rot and was found chiefly on the Early Blacks. Phomopsis was common on the Early Blacks and Glomerella on the Howes during both years. Phomopsis and Glomerella were more abundant early in the season, while Fusicoccum was rarely observed early in the storage period, but became more abundant later.

Preventive treatment of Oïdium, J. Kunstler (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 7, pp. 406, 407.*)—A handful of sulphur covered in the soil about the base of practically barren grapevines at a depth of 10 to 20 cm. (4 to 8 in.), is said to have checked development of Oïdium. The beneficial

effects are ascribed to the production of sulphur dioxid gas resulting from oxidation in the soil.

Control of Peronospora by the incubation calendar method, K. Müller (*Jahresber. Ver. Angew. Bot., 16 (1918), No. 2, pp. 21–28*).—A brief account is given of methods looking to economical and effective control of grape Peronospora by timeliness in spraying.

A new host plant of toothwort, G. Schellenberg (*Ber. Deut. Bot. Gesell., 37 (1919), No. 9, pp. 427–429*).—An account is given of the spontaneous growth of *Lathræa squamaria* on *Salix alba* in the botanical garden of Kiel University.

Plane tree disease, R. Laubert (*Gartenwelt, 24 (1920), No. 38, pp. 357–360, figs. 4*).—Plane tree disease is discussed as regards synonymy and control by means of fungicides.

Scientific instruments and patent rights, D. Reddick (*Abs. in Phytopathology, 10 (1920), No. 1, p. 67*).—The author outlines a plan for the testing, patenting, and marketing of scientific apparatus intended for pathological work.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A contribution to the life history of the Wyoming ground squirrel (Citellus elegans) in Colorado, I, W. L. Burnett (*Colo. State Ent. Circ. 30 (1920), pp. 12, figs. 2*).—This paper includes an account of the general distribution of *C. elegans*, which is found in Colorado, Wyoming, and Utah and may occur east of the Nebraska line; its distribution by counties in Colorado; and its breeding habits.

Description of a new chipmunk from Glacier National Park, Montana, A. H. Howell (*Biol. Soc. Wash. Proc., 33 (1920), pp. 91, 92*).

Report on methods of rat destruction, E. G. Boulenger and P. C. Mitchell (*Zool. Soc. London Proc., 1919, III–IV, pp. 227–244*).—This consists largely of a report by the senior author on the poisoning of rats with phosphorus, arsenic, barium carbonate, and squill, and the use of virus, trapping, gassing, etc.

The prevalence of Leptospira icterohæmorrhagiæ in the wild rats of Sao Paulo, Brazil, W. G. Smillie (*Bul. Soc. Path. Exot., 13 (1920), No. 7, pp. 561–568, fig. 1*).—"The kidneys of 41 normal appearing rats captured in the city of Sao Paulo were inoculated into guinea pigs with result that four of the guinea pigs developed typical symptoms of epidemic jaundice, and *L. icterohæmorrhagiæ* were found in their organs. Three of four strains of Leptospira were cultivated according to the method A of Noguchi. A large proportion of the guinea pigs inoculated with rat kidneys developed a high immunity to a virulent strain of *L. icterohæmorrhagiæ*. Thus it seems probable that a large percentage, 75 per cent or more of Sao Paulo rats, harbor *L. icterohæmorrhagiæ* of a low virulence, which produced immunity in the guinea pigs without producing objective symptoms."

Notes on North American birds, X, H. C. Oberholser (*Auk, 38 (1921), No. 1, pp. 79–82*).—A continuation of papers previously noted (E. S. R., 41, p. 846).

Five new species of birds from cave deposits in Porto Rico, A. Wetmore (*Biol. Soc. Wash. Proc., 33 (1920), pp. 77–81, pls. 2*).

The geographic races of Cyanocitta cristata, H. C. Oberholser (*Auk, 38 (1921), No. 1, pp. 83–89*).

Descriptions of five new subspecies of Cyornis, H. C. Oberholser (*Biol. Soc. Wash. Proc., 33 (1920), pp. 85–87*).

The turtles of North Carolina; with a key to the turtles of the eastern United States, C. W. Brimley (*Jour. Elisha Mitchell Sci. Soc., 36 (1920), No. 1–2, pp. 62–71*).—A key is given for the identification of practically all turtles found east of the Mississippi River, excluding strictly Mississippi Valley species.

Report of the department of entomology (*Oregon Sta. Crop Pest and Hort. Rpt. 3 (1915–1920), pp. 58–130, figs. 32*).—The papers presented in this third report (E. S. R., 32, p. 651) are as follows: The Western Peach and Prune Root Borer (*Sanninoidea opalescens* Edw.), by F. H. Lathrop and A. B. Black (pp. 59–70); Improved Sprays and Practices in Codling-moth Control, by L. Childs and A. L. Lovett (pp. 71–81); The Fruit Tree Leaf Roller (*Archips argyrospila* Wlk.), Report on Progress of Investigations, by B. B. Fulton (pp. 82–88); Chemical and Physical Properties of the Arsenates of Lead, by R. H. Robinson (pp. 89–94); The Pear Thrips (*Taeniothrips inconsequens* Uzel), by A. L. Lovett (pp. 95–102); Flat-headed Borers which Attack Orchard Trees and Cane Fruits in Oregon, by W. J. Chamberlin (pp. 103–108); Grasshopper Control in Oregon (pp. 109–115) and The Alfalfa Weevil (pp. 116–118), both by B. B. Fulton; the Loganberry Crown Borer (*Bembecia marginata* Harr.), by A. L. Lovett (pp. 119, 120); Amounts of Spray Required on Trees of Different Ages in the Different Applications, by L. Childs (pp. 121, 122); The Rusty Leafmite (*Phyllocoptes schlectendali* Nal.), by F. H. Lathrop, (pp. 123, 124); Tree Crickets, by B. B. Fulton (pp. 125, 126); and General Insect Notes (pp. 127–130.)

The paper on *S. opalescens* consists of a brief review of investigational work under way. Referring to the use of asphaltum, applied to the bases of the trees, a report upon which by Morris has been previously noted (E. S. R., 27, p. 54), it is stated that tests in several States have shown this treatment to be unsatisfactory. Digging the borers from their tunnels is still the most thoroughly reliable treatment. Recent experimental work by the station and favorable reports from commercial orchardists indicate that whitewash, consisting of quicklime 8 lbs., arsenate of lead (powder) 0.25 lb., salt 2 lbs., glue (flake or granulated) 0.25 lb., nicotin sulphate (40 per cent) 2 oz., and water to make a thick paint, applied to the base of the trees to a depth of 3 to 4 in. below the surface and to a height of 14 to 16 in. will give good results. The first application should be applied in connection with worming in the spring, as immediately preceding July 1 as possible, and again about mid-August. In the work of 1920 naphthalin washes gave the best results, but they can not be recommended until more data have been obtained.

In reporting upon the fruit tree leaf roller it is stated that the treatment that will give the most successful control is a spray of a heavy miscible oil, 8 gal. to the hundred, applied after the buds show green at the tip and before the blossom cluster buds begin to spread apart. See also a previous note by Gill (E. S. R., 28, p. 754). The oblique-banded leaf roller (*Archips rosaceana* Harr.) occurs in Oregon in about the same territory but has not as yet become a serious pest.

The flat-headed borers which attack orchard trees and cane fruits in Oregon are the flat-headed apple-tree borer, the Pacific flat-headed apple-tree borer (*Chrysobothris mali*), and the flat-headed prune-tree borer (*Dicerca pecterosa*).

In the control of the rusty leafmite it appears that sulphur, either as a liquid or dust application, gives good results during the summer months when the mites are exposed on the foliage.

Under the heading of general insect notes the occurrence of the shot-hole borer (*Xyleborus dispar*), the peach twig-moth, bud weevils, the raspberry sawfly, the black gooseberry borer (*Xylocrinus cerebratus*, *X. agassizii*), the Mexican bean beetle or bean ladybird (*Epilachna corrupta* Meuls), the carrot beetle (*Lygus gibbosus*), and several blister beetles are noted.

[Report of the] department of entomology (*Oregon Sta. Rpt. 1919–20, pp. 59–63*).—This is a brief report on investigations conducted during the fiscal years 1919 and 1920, including work with the peach and prune root borer, aphids

injurious to apples, and other projects. In reference to work with beneficial insects it is stated that five important parasites of the apple leaf roller were found present in the Imbler and Hood River fruit districts.

Work with leaf rollers and fruit worms of apple and pear, namely, *Archips argyrospila* and *A. rosaceana*, of which the latter is of minor importance, has shown that oil sprays applied in April give from 50 to 90 per cent control. Calyx sprays of oil, arsenate, and Blackleaf 40 killed about 33 per cent of the young larvae. In 1920 it was found that heavy oils gave better kill than light oils; late applications gave better kill than early, the nearer the hatching period the better.

Twelfth annual report of the Quebec Society for the Protection of Plants from Insects and Fungus Diseases, 1919–20 (*Quebec Soc. Protect. Plants [etc.], Ann. Rpt., 12 (1919–20), pp. 60, pls. 8, figs. 14*).—Included in this, the usual annual report (E. S. R., 42, p. 748), are papers by W. Lochhead on The Natural Control of Insects (pp. 10–21), The European Corn Borer (pp. 36–43), and An Important Bioclimatic Law (pp. 50–53), accounts of which have been noted (E. S. R., 41, p. 16; 42, p. 545).

Report of the entomologist [of Ceylon], J. C. Hutson (*Ceylon Admin. Rpts. Sect. IV, Rpt. Dir. Agr., 1919, pp. 8–11*).—The author presents notes on the occurrence of the more important pests of the year. A brief report by F. P. Jepson on the tea shot-hole borer investigation, and one by N. K. Jardine on the tortrix investigation are included.

[Report on grain pests] (*Roy. Soc. [London], Grain Pests (War) Com. Rpts., No. 8 (1920), pp. 28, pls. 11*).—This is in continuation of the papers on the subject previously noted (E. S. R., 40, p. 855; 43, p. 254). Three papers are presented, as follows: Bionomic, Morphological, and Economic Report on the Acarids of Stored Grain and Flour, II, by R. Newstead and H. M. Morris (pp. 3–15), Report on the Nonparasitic or Forage Acari of the Family Tyroglyphidæ, by R. Newstead and H. M. Morris (pp. 16–25), and Clinical Notes on the Nonparasitic or Forage Mites, by A. W. N. Pillers (pp. 26–28).

The conclusions drawn from the first paper are as follows:

"In addition to *Aleurobius farinæ*, *Histiogaster entomophagus*, *Tyroglyphus longior*, and possibly *Glyciphagus fuscus* are capable of damaging flour in storage. A relatively high moisture content in both wheat and flour is essential for the existence of the various species of acari. Preventive measures are far more satisfactory than remedial measures. Attacks by mites may be prevented by storing only flour the moisture content of which is below 11 per cent in the Temperate Zone, and a much lower percentage in tropical countries. The storing of uninfested flour in hermetically sealed receptacles would no doubt be efficacious if properly carried out; but our experiments show that if the flour is already infested with mites some may survive even after hermetic sealing for over two months."

[Insect enemies of the tea plant], W. Roepke and C. Bernard (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Proefsta. Thee, No. 67 (1919), pp. 24, figs. 19*).—Two papers are here presented, the first by Roepke on the flower bud bug, *Hyalopeplus smaragdinus* Rpk. (pp. 1–10), the second by Bernard on the tea seed bug, *Poecilocoris hardwickii* (pp. 11–24).

Two insect pests of tea in Ceylon, F. A. Stockdale (*Trop. Agr. [Ceylon], 55 (1920), No. 5, pp. 276–279, pls. 2, fig. 1*).—This paper, presented before the Imperial Conference of Entomologists held in London in June, 1920, relates to the shot-hole borer (*Xyleborus fornicatus*) and the tea tortrix (*Homona coffearia*).

Chemical investigations of insecticides (*Oregon Sta. Rpt. 1919–20, pp. 38, 39*).—When lime sulphur, diluted for summer spraying, was mixed with lead

hydrogen arsenate, the active insecticidal and fungicidal properties of the combination spray were decreased appreciably. Investigations showed that about 50 per cent of the polysulphid sulphur reacts with the arsenate of lead to form sulphid of lead and a soluble salt of arsenic. The addition of slaked lime to the lime sulphur apparently prevented the chemical changes. Analyses of a mixed spray to which slaked lime had been added showed no arsenic in soluble form and very little change in the polysulphid content. For the lime-sulphur lead-arsenate spray, the addition of lime at the rate of 10 lbs. for each 100 gal. of solution is recommended.

Miscellaneous soil insecticide tests, J. J. Davis (*Soil Sci., 10 (1920), No. 1, pp. 61–75, pls. 2*).—Work with carbon disulphid indicates that its use against most white grubs and similar insects is impractical, but that it can be used to advantage to destroy ant colonies and to kill grubs which have an open burrow, such as those of the southern green June beetle (*Cotinis nitida*).

An 8 per cent kerosene emulsion at the rate of 1 gal. to 4 sq. ft. used against the grubs of the green Japanese beetle (*Popillia japonica*) caused a mortality of 25 to 54 per cent. It is concluded, however, that kerosene emulsion is not so satisfactory a soil insecticide as is cyanid since it is less effective, more expensive, and more difficult to make up and apply.

Experiments with Carco, a commercial preparation, and Barrett's disinfectant, which is of about the same composition and much cheaper, showed the latter to be only slightly less effective against grubs of the green June beetle than kerosene emulsion, when diluted 1 to 125 parts of water and applied the same as the emulsion, i. e., 1 gal. of diluted mixture to 6 or 8 sq. ft. and afterwards sprinkled with water. Details of results obtained with Barrett's disinfectant against Popillia grubs at Riverton, N. J., are reported in tabular form. As a soil insecticide against the commoner white grubs it appears to be equal to kerosene emulsion, but not so good as sodium cyanid.

Sodium cyanid, used at the rate of approximately 110 lbs. in 26,000 gal. of water per acre gave an average kill of 25 per cent. A modification of the sprinkler pipes in the fall resulted in an average kill of about 80 per cent, the average up to the latter part of October being about 90 per cent, but rapidly dropping off as the cold weather set in. Granular sodium cyanid was used at the rate of 165 lbs. in 12,000 gal. per acre. "Applications of dry cyanid, broadcasted or drilled, and the treated area afterwards watered gave appreciably and uniformly poorer results than where the cyanid was applied in liquid form. Where comparisons were possible we observed that cyanid was more effective against Cyclocephala, Lachnosterna, and Macrodactylus grubs than against Popillia; in some cases the difference was apparently due to greater resistance, and in some cases because the Popillia grubs were earlier influenced by approaching cold weather and had penetrated deeper during the latter part of October than had the other grubs."

The use of carbon disulphid against the white grub, W. H. W. Komp (*Soil Sci., 10 (1920), No. 1, pp. 15–28*).—Investigations here reported, which were conducted at the New Jersey Experiment Stations, have shown "that the maximum dosage for ordinary lawn and golf-green grasses lies somewhere between 1 and 5 oz. per square foot and considerably above the former, while the minimum dosage for the white grub is about 1 oz. Temperature is shown to exert a decided influence on the minimum dosage for the white grub (1 oz. at 65° F. and less than 1 oz. being necessary at 85° or above) and presumably also upon the maximum dosage for the plants. Effective work against the grub appears to require injections not much over 6 in. apart. The soil moisture must be medium (10 per cent) to wet (20 per cent) for good results in grub destruction. Wetting the surface of the soil in cases when the moisture is dry (5

per cent) to medium (10 per cent) seems to increase the effectiveness of the treatment. The charge should be placed several inches below the point where the grubs are working.

"In general it may be said that this study seems to show that the control of the white grub when it occurs in situations in which it can not be reached practically by cultural methods may be effected by fumigation of the soil by means of carbon disulphid. The combination of its effectiveness against the white grub, its nonpoisonous effect on plants when used in small quantities, and the stimulating effect which small dosages have upon lawn vegetation make it a promising means of control for the white grub. Its relatively high cost will prove a limiting factor."

Termites, or white ants, in Hawaii, D. T. FULLAWAY (*Hawaii. Forester and Agr., 17 (1920), No. 10, pp. 294–301, pls. 10*).—This is a summary of information on the termites found in Hawaii, of which there are four species, their classification, injury, and methods of control.

Suggestions on pear thrips control, E. O. ESSIG (*Calif. Univ. Jour. Agr., 6 (1920), No. 8, pp. 6, 31, fig. 1*).—Experiments conducted during the past season with the material which has proved effective in controlling the walnut aphis, commercially known as Nicodust (finely ground kaolin treated with Blackleaf 40), gave encouraging results in controlling both the adult and young pear thrips. A dust containing 5 per cent Blackleaf 40 or 2 per cent nicotin was used, its cost averaging 3.75 cts., for an ordinary prune tree. With a power blower and two men 20 acres can be dusted in a day, while one man with a hand duster can treat from 2 to 3 acres a day. The author does not recommend the substitution of dust for spraying, but rather suggests it as a valuable adjunct, the merit of which only time and further experimental work can fully determine.

Notes on Pediculus vestimenti, K. FOOT (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 39 (1920), No. 5, pp. 261–279*).—These notes relate to observations on the bionomics of *P. vestimenti* made during the course of two years' work in France.

Cercopidæ of the vicinity of Washington, D. C., with descriptions of new varieties of Clastoptera (Homoptera), W. L. MCATEE (*Biol. Soc. Wash. Proc., 33 (1920), pp. 171–176*).

Anuraphis longicauda, a new aphid injurious to plum trees, A. C. BAKER (*Biol. Soc. Wash. Proc., 33 (1920), pp. 93–95*).—An undescribed aphis, which for several years has occurred in injurious numbers on plum trees at Vienna, Va., and has also been found at Ashland, Nebr., and House Springs, Mo., is here described as new, under the name *A. longicauda*. It attacks both the twigs and the leaves of plum trees, and the twigs attacked are in nearly every case dead the following year. It is found either upon the twigs or the foliage throughout the summer, and the apterous sexes are met with upon the twigs, where the eggs are laid in the fall. While the spring forms are usually a dark brown, many of the summer forms are pale yellowish white, and these forms are most often seen on the under sides of the leaves. A description is given of the stem mother and apterous viviparous and alate viviparous females.

The Coccidæ of South Africa, IV, C. K. BRAIN (*Bul. Ent. Research, 10 (1920), No. 2, pp. 95–128, pls. 8*).—In continuation of the papers previously noted (E. S. R., 42, p. 155), 43 forms are considered. The genus Baccacoccus is erected, and 20 forms are described as new.

The European corn borer, R. H. PETTIT (*Michigan Sta. Circ. 44 (1920), pp. 3, fig. 1*).—Attention is called to the importance of this pest, with a view to preventing its advance from St. Thomas, Can., where it now occurs.

Codling-moth control in British Columbia, R. C. Treherne and H. H. Evans (*Better Fruit, 15 (1920), No. 5, pp. 3–5, fig. 1*).—This is a discussion of the codling moth situation in British Columbia, including a summary of the life history of the moth with spray dates during the years 1916 to 1919.

The egg-laying habits of Californian anophelines, W. B. Herms and S. B. Freeborn (*Jour. Parasitol., 7 (1920), No. 2, pp. 69–79, figs. 2*).—"The process of egg deposition in *Anopheles punctipennis* is described. The number of eggs deposited per laying is found to be greater than hitherto recorded. *A. quadrimaculatus* averaging 209 eggs and *A. punctipennis* 203 per laying. Descriptions are given of the eggs of the Californian anophelines whereby they may be differentiated, including a description of the egg of *A. pseudopunctipennis*, which represents a marked departure from the usual anopheline type. Observations are introduced to indicate that specific breeding places are due to selective oviposition. The incubation period of the eggs of *A. quadrimaculatus* is 2.5 days, *A. punctipennis* 3.2 days, and *A. pseudopunctipennis* 3 days. It was found that the eggs of *A. quadrimaculatus* could withstand drying for 72 hours, but that those of *A. punctipennis* failed to hatch after 24 hours of drying."

Notes on the mosquito fauna of North Carolina, F. Sherman (*Jour. Elisha Mitchell Sci. Soc., 36 (1920), No. 1–2, pp. 86–93*).—This paper includes an annotated list of 32 species recorded from North Carolina.

Spraying as a preventive for blowflies.—Trials at Trangie Experiment Farm, A. H. MacDougall (*Agr. Gaz. N. S. Wales, 31 (1920), No. 9, pp. 617, 618*).—This is a report of experiments conducted in continuation of those previously noted (E. S. R., 41, p. 852). The benefit derived from the treatments, which included (1) a proprietary powder dip containing arsenic and sulphur, (2) 1 lb. arsenic to 50 gal. of water, and (3) a proprietary liquid dip having carbolic acid as its basis, appeared to be in the prevention of attacks, in which respect the carbolic dip gave the best results.

Diptera of the superfamily Tipuloidea found in the District of Columbia, C. P. Alexander and W. L. McAtee (*U. S. Natl. Mus. Proc., 58 (1920), pp. 385–435, pl. 1*).

Catalogue of oriental and south Asiatic Nemocera, E. Brunetti (*Indian Mus. Rec., 17 (1920), pp. 300*).—This catalogue, which is based upon work extending over a number of years, includes an index to families, genera, and species.

The white-fly eating Delphastus, J. R. Watson (*Fla. Univ. Ext. Bul. 24 (1920), pp. 35–37*).—This is a brief discussion of the status of the lady beetle, *Delphastus* sp., which was introduced from California and has now become established at Bradentown and Crescent City, Fla.

The cranberry rootworm beetle (Rhabdopterus picipes Oliv.) as an apple pest (Coleoptera), W. S. Sawyer (*Canad. Ent., 52 (1920), No. 12, p. 265, pl. 1*).—Injury by this beetle to apples in an orchard near Sodus, N. Y., was first called to the author's attention on June 28, 1920. It confined its attack to the fruit, especially Grimes Golden, in which it eats out a shallow, irregular, hieroglyphic-like channel on the surface. About 75 per cent of the apples were injured in this manner. The beetles continued feeding until about the middle of July, after which time they were found feeding upon the foliage of Virginia creeper, dock, and wild strawberry. Its work during the past season seemed to be confined to the vicinity of Sodus and Savannah, N. Y. Arsenate of lead powder in summer strength lime sulphur (5 lbs. to 100 gal.), applied with great thoroughness, failed to kill the beetles or drive them away.

A new hispid beetle injurious to the oil palm in the Gold Coast, S. Maulik (*Bul. Ent. Research, 10 (1920), No. 2, pp. 171–174, figs. 3*).—*Coelaenomenodera elaeidis*, which has suddenly become a pest, due to its destroying the

expanded foliage of many thousand oil palms (*Elæis guineensis* Jacq.) in one district in the Gold Coast, is described as new.

Notes on ecology of injurious Tenebrionidæ (Col.), J. S. WADE (*Ent. News, 32 (1921), No. 1, pp. 1–6*).

Shot-hole borer of tea, F. P. JEPSON (*Trop. Agr. [Ceylon], 55 (1920), No. 5, pp. 280–289*).—This is a progress report of the work for a six months' period ending June 30, 1920.

The palm pit borer, an enemy of oil palm culture, S. LEEFMANS (*Dept. Landb. Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 37 (1919), pp. 8, pl. 1*).—This relates to a bruchid of the genus Caryoborus or Pachymerus, which attacks the seeds of the oil palm in the Dutch East Indies.

The southern pine beetle, a menace to the pine timber of the Southern States, A. D. HOPKINS (*U. S. Dept. Agr., Farmers' Bul. 1188 (1921), pp. 15, figs. 5*).—This is a popular account of *Dendroctonus frontalis* Zimm., the most destructive enemy of pines in the Southern States from Pennsylvania to Texas, where it has killed more merchantable-sized timber during the last 30 years than has died from all other causes combined. It is pointed out that the prevention of serious outbreaks and the control of this menace to the great timber resources of the South are not only possible but entirely practicable, since it is only necessary to cut, and utilize for fuel or lumber during the fall and winter months, all trees that die during the late summer and fall, making sure that the bark of the main trunk is burned.

Technical accounts of this beetle by the author are included in bulletins previously noted (E. S. R., 22, p. 157).

Spraying for the alfalfa weevil, G. I. REEVES, T. R. CHAMBERLIN, and K. M. PACK (*U. S. Dept. Agr., Farmers' Bul. 1185 (1920), pp. 20, figs. 9*).—This discusses the alfalfa weevil and gives directions for its control by means of arsenical sprays. The treatment recommended is based upon experiments extending over a period of seven years and a season of thorough field trial in cooperation with farm bureaus, in the course of which over 4,000 acres were successfully sprayed by practical farmers. Arsenate of lead and arsenite of zinc have been used on a large number of fields with complete success, and it is deemed likely that other arsenical poisons recommended for orchard spraying are equally good. They should be used at the rate of 2 lbs of the powder or 4 lbs. of the commercial paste for each 100 gal. of water, to which 2 lbs. of laundry soap for each 100 gal. is added.

The application should be made at the so-called turning point in injury, which comes from one to two weeks before the first crop is ready for cutting. Up to the so-called turning point the plants outgrow the injury caused by the increase in numbers of the alfalfa weevil larvæ, but at this time the larvæ become so numerous as to completely destroy the growing tips and thus stop the growth of the plants. It is shown that the time of the turning point varies from year to year with weather conditions. In well-watered sections of the country, where a second crop can be grown, the profit realized from the first crop is only part of the results of spraying, the greater gain being in the protection of the second crop.

While stubble spraying has been successfully done by a number of farmers, it requires getting upon the field immediately after cutting, and a much larger quantity of liquid per acre is needed than if applied to the first crop. Stubble spraying can only be advised when earlier spraying has been impossible.

The best results in applying insecticides have been obtained with nozzles working 2 ft. above the alfalfa, each nozzle as it moves across the field spray-

ing a strip 2 ft. wide. Application should be made at the rate of 100 gal. of spray mixture per acre at a pressure not lower than 75 lbs. The success of the work depends largely upon covering as nearly as possible all the upper foliage. "Twenty-five acres can be covered easily in a day with a 10-nozzle machine, and this speed, with the low cost and the protection given to both crops at one operation, makes the spraying method superior to all others for the control of the alfalfa weevil. The actual cost is about $1 per acre."

Queen-mating experiments, F. W. L. Sladen (*Gleanings Bee Cult., 48 (1920), No. 12, pp. 717, 718, fig. 1*).—This is a report of experiments in continuation of those begun on Duck Island in 1919, previously noted (E. S. R., 42, p. 549). Fifteen virgin queens were taken to the island on July 28 just as the basswood flowers were beginning to open, 9 on August 4, and 12 on August 14. The result was 27 perfect matings, 2 imperfect matings, and 7 queens lost. The workers produced from 26 perfect matings, when examined, were found to be lightly colored enough to show that the queens had been mated with Italians introduced from selected colonies at the experimental farm. It is planned to test the island-mated queens for nonswarming and honey production in 1921, and to rear queens and drones on Duck Island from those selected.

Bee-breeding experiments, F. W. L. Sladen (*Agr. Gaz. Canada, 7 (1920), No. 11, pp. 866–868, fig. 1*).—This is a brief summary of the work carried on by the Dominion apiarist, particularly that on Duck Island, above noted.

An index to bee literature from 1890 to 1918, A. Brosch and L. Armbruster (*Arch. Bienenkunde, 1 (1919), No. 7–8, pp. 75*).—This is a classified list of the literature relating to apiculture, arranged by authors.

Notes on Nosema apis Zander, R. Kudo (*Jour. Parasitol., 7 (1920), No. 2, pp. 85–90, figs. 3*).—"Among honeybees collected at Spring Valley, N. Y., from August 27 to September 5, 1920, 3.8 per cent were found to be infected by *N. apis*. Four bees harbored an undetermined microsporidian. Fresh spores of *N. apis* measure from 4.6 to 6.4 μ long, and from 2.5 to 3.4 μ broad and thick. A method of applying mechanical pressure to cause the filament extrusion of microsporidian spores is described. The polar filament of the spore of *N. apis* is 230 to 280 μ in length. The structure of the spore is similar to that of *Thelohania magna*. Extruded polar filaments show two parts, one with larger and the other with smaller undulations, each composed of 10 to 15 turns, indicating that the filament is doubly coiled."

Some relations between ants and fungi, I. W. Bailey (*Ecology, 1 (1920), No. 3, pp. 174–189, pls. 3*).—The paper includes discussions of the structure and function of the infrabuccal cavity, the fungivorous habit among Formicidæ, ants as active agents in the dissemination of fungi, the origin of the fungus-growing and fungus-feeding habits, etc. A list of 31 references to the literature is included.

The North American ichneumon flies of the tribe Ephialtini, R. A. Cushman (*U. S. Natl. Mus. Proc., 58 (1920), pp. 327–362, pl. 1, fig. 1*).—This paper includes descriptions of seven new species.

An investigation of the dipping and fumigation of nursery stock, K. C. Sullivan (*Missouri Sta. Bul. 177 (1920), pp. 36, figs. 6*).—A general account is first given of the San José scale, its occurrence in Missouri, and measures that have been taken for its control. Experimental work with insecticides is then reported upon. The data presented, most of which are in tabular form, relate to work with hydrocyanic-acid gas, carbon bisulphid, lime sulphur, miscible oil, and nicotin sulphate, respectively.

While hydrocyanic-acid gas did not in every case give complete control, when used at a strength of 1:1:3 it gave better results than the weaker strength of

0.5 : 0.5 : 1.5. The 1 : 1 : 3 strength gave as good results as the 2 : 2 : 6. Sodium cyanid used at the strength of 1 : 1.5 : 3 killed 100 per cent of the scale.

"Hydrocyanic-acid gas was more effective when used upon dry plants than upon wet. A larger percentage of the scale was killed. All strengths of the hydrocyanic-acid gas caused more or less injury to the plants. The stronger it was used, the more injury it caused. The 1 : 1 : 3 formula should always be used in fumigating nursery stock, and the stock should be dry. There may be greater danger of injury to the plants, but the scale will be more completely controlled, and this is the most important factor.

"Carbon bisulphid did not control the scale and it caused a very high percentage of injury. Its use as a fumigating material for the control of San José scale on nursery stock should be discouraged.

"Lime sulphur used at 1 : 9 and 1 : 7 strengths gave fairly good results in controlling the scale. The 1 : 9 solution gave perfect results on pears and plums. The sulphur dips injured the plants to some extent. The plants dipped both tops and roots showed more injury than those dipped tops only.

"The miscible oil gave the best results, 100 per cent of the scale being controlled in every case but one, and in this case the control exceeded 99 per cent. Miscible oil caused some injury to the plants. Those dipped tops and roots were injured most. When treating nursery stock with miscible oil, the roots should not be dipped. Lemon oil or nicotin sulphate should not be used as dips for controlling scale on nursery stock.

"None of the materials used completely controlled the San José scale. All scale-infested nursery stock should be burned or destroyed in some other way. Nursery stock which has been subjected to infestation but is not infested should be treated before being placed on the market. The best results should be expected by treating the stock with hydrocyanic-acid gas 1 : 1 : 3 or with miscible oil at the strength of 1 : 12 or 1 : 15, tops only."

A list is given of 33 references to the literature.

A study of the bulb mite (Rhizoglyphus hyacinthi Banks), P. Garman (*Connecticut State Sta. Bul. 225 (1921), pp. 113–132, pls. 3, figs. 3*).—An investigation of the literature has led the author to conclude that the bulb mite, which was found in nearly all shipments of the more than 1,000,000 bulbs inspected in Connecticut during 1919, should be known as *R. hyacinthi* (Banks), since the *hyacinthi* of Boisduval is a nomen nudum, and the *echinopus* of Fumouze and Robin appears to be a different species.

Technical descriptions are given of the several stages in the life of the mite, including the three nymphal instars, known, respectively, as the protonymph, the deutonymph or hypopus, and the tritonymph. The author records infestation of narcissus, hyacinth, tulip, crocus, and Easter lily bulbs by the mite, and in the laboratory it has been reared on onions and potatoes and is probably capable of subsisting on almost any tuber or bulb. Its common occurrence in narcissus and lily bulbs may be due to the fact that these bulbs are the least resistant to attack, since the scales are loose and the mites find it easy to penetrate to the interior. Tulips are least injured, owing to their outer skin and tight-fitting scales. Hyacinths seem to be less easy to penetrate than narcissus, while onions, artificially infested with mites, were not injured unless they were partly rotten or bruised. In tests made by the author, the mites have entered and fed on growing narcissus bulbs.

The life-history studies of this mite by Yagi in Japan (E. S. R., 42, p. 656) and Michael in England (E. S. R., 15, p. 691) are referred to. The life period obtained at room temperature (averaging about 68° F.) varied from 17 to 27 days, while at a temperature ranging from 70 to 80° it varied from 9 to 13

days. The mite was found to become torpid at 50 to 55° and at about 95°. Incubation of the egg requires from 4 to 7 days. The species molts three times, and when hypopi appear there are four molts. The larval period lasts from 3 to 8 days, the last day or two being spent in a torpid or quiescent condition. The protonymphal period lasts 2 to 4 days, followed by a second quiescent period of about 2 days. The hypopial stage, when it occurs, lasts from 1 to 2 weeks, while the tritonymphal stage lasts from 1 to 2 days.

The number of eggs deposited is said to vary considerably, one individual having laid as many as 130 eggs. The dimorphic male, with an enlarged third pair of legs, is a form of more or less frequent occurrence. It is pointed out that the hypopus is a form similar to some of its ancestors, which is produced from time to time from no apparent reason other than a strong tendency to revert to type, and is a provision of nature for the distribution of the species occurring irrespective of adverse conditions. The author finds hypopi to be produced in dry as well as moist cells, but more rapidly and frequently more abundantly in the latter. The hypopus is much more active than the remaining stages in the life cycle of the mite, having a tendency to wander from place to place and also to attach itself to any moving object. The hypopi were found to attach themselves to small fly larvæ infesting the bulbs, especially *Scatopse pulicaria* Loew, and also to the backs of predacious mites and to lepidopterous larvæ, thus being afforded an adequate means of transportation and dissemination.

Tests made of insecticides show that dipping the bulbs in nicotin sulphate, 14:400, or nicotin oleate, heated to 50° C. (122 F.) is one of the most satisfactory means of destroying the mites, while hot water (50° C.) also kills a good percentage. Tests made of a number of other insecticides with less satisfactory results are briefly reported upon.

The dust method for controlling rust mites on citrus trees, W. W. Yothers (*Fla. Univ. Ext. Bul. 24 (1920). pp. 29–32*).—The author reports briefly upon several experiments conducted which show that mites are so sensitive to sulphur that dusting as a method is considered very promising. Within an hour after an application consisting of 80 per cent sulphur and 20 per cent hydrated lime used at the rate of about 1 lb. per tree, all mites were found to have been killed, and about the same result was obtained from the use of flowers of sulphur alone. It is estimated that a team and two men can dust 40 acres per day at a cost of about 4.7 cts. per tree.

Ticks found on man and his domestic animals and poultry in South Africa, G. A. H. Bedford (*Union So. Africa, Dept. Agr. Jour., 1 (1920), No. 4, pp. 317–340, figs. 29*).—This is a summary of information on the ticks, their classification, and brief accounts of their life histories. A list of ticks which have been found on man and domestic animals and poultry in South Africa, arranged by hosts, and a table of the diseases transmitted by South African ticks are appended.

Ticks and their control, P. J. du Toit (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 19 (1917), No. 1, pp. 1–16; 19 (1918), Nos. 2, pp. 97–128; 3, pp. 210–241*).—The subject is discussed under the headings of (1) ticks as transmitters of disease, (2) notes on their biology, (3) the manner in which they transmit disease, (4) ticks as ectoparasites, and (5) control measures. A bibliography of six pages is included.

On the migratory course of Trichosomoides crassicauda (Bellngm.) in the body of the final host, S. Yokogawa (*Jour. Parasitol., 7 (1920), No. 2, pp. 80–84*).—"The infestation of rats with the bladder nematode, *T. crassicauda*, was accomplished by feeding the eggs. The finding of larvæ of this species in

the body cavity, pleural cavity, and lungs of an experimental rat fed with large numbers of eggs suggests that in the life cycle of this species the larvæ must pass to the lungs before they can establish themselves in their normal habitat. This observation and other recent studies strengthen the view that migration to the lungs is a common phenomenon in the life cycle of nematodes. How larvæ reach the bladder from the lungs was not determined, but they probably are not carried in the blood vessels."

FOODS—HUMAN NUTRITION.

Abstracts of papers at the National Congress of Physiology, Paris (1920) (*Cong. Physiol., 1920, Résumés Commun., pp. 375*).—Abstracts and titles are given of a number of papers on nutrition, calorimetry, and a great variety of other topics, as published in advance of the meeting of the International Congress of Physiology at Paris, July 16–20, 1920.

Pork on the farm.—Killing, curing, and canning, F. G. Ashbrook, G. A. Anthony, and F. P. Lund (*U. S. Dept. Agr., Farmers' Bul. 1186 (1921), pp. 44, figs. 22*).—In this revision of Farmers' Bulletin 913 (E. S. R., 38, p. 476) the specifications for ice houses for the cold storage of pork products have been replaced by directions for the home canning of pork and pork products, including descriptions of methods of canning in tin cans and glass jars, and recipes for the preparation of different pork products for canning.

Digestibility of raw rice starch, C. F. Langworthy and H. J. Deuel (*Cong. Physiol., 1920, Résumés Commun., pp. 186, 187*).—In experiments with young men as subjects, raw rice starch (an average of 175 gm. per man per day), taken in the form of frozen pudding, was completely digested. No physiological disturbances were noted, and the subjects seemed in normal health during the experimental period, which was of three days' or nine meals' duration.

Supplementary researches on the manufacture of nuoc-mam, J. Mesnard and E. Rosé (*Ann. Inst. Pasteur, 34 (1920), No. 9, pp. 622–649*).—The authors report a laboratory study of the chemical changes involved in the preparation of nuoc-mam, a Chinese fish sauce, an article on the manufacture of which has been previously noted (E. S. R., 41, p. 66). The data obtained in this study have led to the conclusion that the active agents in the formation of nuoc-mam are the diastases of the organs of the fish, somewhat checked by the high concentration of the salt but at the same time protected against the action of putrefying organisms whose proteolytic action would result in the formation of ammonia unutilizable by the human organism.

Workingmen's standard of living in Philadelphia, W. C. Beyer, R. Davis, and M. Thwing (*New York: Macmillan Co., 1919, pp. X+125, figs. 3*).—The standard advocated in this volume was based on a study made in 1917–1918 of all items of expenditure in the families of 260 workingmen. It calls for a diet supplying 110.8 gm. of protein, 460.4 gm. of carbohydrates, 92.2 gm. of fat, and 3,150 calories of energy per man per day. In a family consisting of parents and three children under 14 years old, the annual cost of such a diet is reckoned at $660.09, or about 40 per cent of the total income. The data on food obtained in this study are compared with figures obtained in a similar study made in 1913–1914, and show a decrease in the use of cereals, meats, fats, and sugars and an increase in the use of meat substitutes (milk, eggs, dried legumes, etc.) and fresh fruits.

Opinions on food control, A. Behre (*Chem. Ztg., 44 (1920), Nos. 114, pp. 701, 702; 115, pp. 709, 710*).—The author discusses some of the inherent faults in the present system of food control in Germany and suggests measures for improvement.

Malnutrition and health education, D. Mitchell (*Pedag. Seminary, 26 (1919), pp. 1–26*).—An account is given of an experiment in health education conducted by the Bureau of Educational Experiments in one of the public schools in New York City. The treatment given consisted of instruction in health habits, removal of physical defects, frequent rest periods, and the supplying of lunches and dinners. At the end of the experiment the increase in weight was about 9 per cent more than the normal increase.

A deficiency in heat-treated milks, A. L. Daniels and R. Loughlin (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 381–397, figs. 13*).—In an attempt to determine the changes brought about in milk by heating in different ways, some of the earlier experiments of Daniels et al. (E. S. R., 34, p. 659) were repeated under slightly different conditions of boiling.

It was discovered that young rats fed on milk which had been brought quickly to the boiling point grew normally, while those fed milk heated slowly to the boiling point grew at about half the usual rate. These results led to an investigation of the effects of commercially canned milk and milk pasteurized by the "hold" system as used in children's hospitals and institutions. Unsweetened evaporated milk and pasteurized milk gave results similar to the slowly heated milk, while undiluted, sweetened condensed milk brought about nearly normal growth.

A study of the causes of these differences has led to the conclusion that the unfavorable action of certain heated milks is due to the separation from these milks of calcium salts in the form of an insoluble precipitate which settles to the bottom or on the sides of the container and is thus lost. In the case of undiluted condensed milk these salts are held in suspension and thus rendered available. This conclusion was verified by the favorable results obtained by supplementing the superheated milk with calcium phosphate, or with the precipitate obtained on the sides and bottom of some of the milk containers. No evidence was obtained that either the fat-soluble or the water-soluble vitamin in the milk was affected by the heat treatment.

The vitamin, W. H. Eddy (*Abs. Bact., 3 (1919), No. 6, pp. 313–330*).—This is a bibliographic review of vitamins under the headings of history, methods of preparation, source, reactions to heat, acids, alkalis, and solvents, chemical structure, explanation of the method in which vitamins function, and organisms that have been shown to require vitamin for their development. A list of 236 literature references is appended.

Some effects of water-soluble vitamin upon nutrition, W. G. Karr (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 255–276, figs. 29*).—The experiments reported in this paper were conducted upon dogs with a view to determining the relation of water-soluble B to nutrition. The three standard diets employed consisted of wheat gluten or commercial casein, lard, sucrose, bone ash, and salt mixture, furnishing daily per kilogram of body weight 18, 19, and 15 gm. containing 0.8, 0.8, and 0.4 gm. of nitrogen, respectively, and each furnishing 8 calories. Vitamin preparations tested included commercial brewery yeast (dried, autoclaved, or redried), bakers' yeast, sterilized milk, a suspension of canned tomato pulp, and a concentrated vitamin extract prepared according to the method of Osborne and Wakeman (E. S. R., 42, p. 314). The plan of the experiment was to feed the vitamin-free food until the dog refused part or all of the diet, and then to administer known amounts of the vitamin-containing substance and note the effect on the food intake.

Most of the dogs consumed the diet readily at first, but after a number of days refused a part of it and ultimately refused to eat any of the food until the vitamin-containing food was given, when the desire to eat was quickly restored. As the vitamin preparation was given separately from the food the

effect could not be attributed to increased palatability. When the vitamin was fed from the start no loss in appetite occurred. The addition of butter to the diet did not effect any appreciable increase in food intake, indicating that the fat-soluble vitamin did not influence the appetite.

The quantity of vitamin necessary to sustain the appetite, while varying slightly with different animals, appeared to be fairly constant for the same animal. The comparative value of the different preparations is shown from the fact that the same dog required 1.5 gm. daily of dried brewery yeast, 4 gm. of autoclaved yeast, 4 gm. of bakers' yeast, 100 cc. of milk, or 200 cc. of the tomato suspension. Little or no destruction of the vitamin in brewery yeast by heating at 100° C. was noted, while heating at higher temperatures caused more or less destruction.

In certain of the animals which continued to eat their food for a longer time without the addition of vitamin, characteristic polyneuritic symptoms appeared which were promptly alleviated by administration of the vitamin extract.

Metabolism studies with diets deficient in water-soluble B vitamin, W. G. KARR (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 277–282*).—The general plan of these studies was to compare the metabolism of dogs recently placed on a vitamin-free diet with their metabolism at a later period on the same diet, and the metabolism on a vitamin-free diet with that on a diet containing water-soluble B, the possible supplementing action of the protein of the crude vitamin being controlled by a further period in which a corresponding amount of pure protein was added. The diets were essentially the same as in the preceding study, casein and gluten being used as the chief source of nitrogen and brewery yeast of vitamin.

The data on the four dogs used in the experiment are very consistent in showing that the nitrogen utilization in the digestive tract was unaffected by the absence of water-soluble B. The nitrogen balance was, however, favorably affected by the addition of small amounts of casein or yeast to a diet in which the protein was furnished by wheat gluten.

"Metabolism experiments on vitamin-free diets are complicated by many factors, especially the intimate relation of water-soluble B vitamin to food intake, and also the possible supplementing action of the protein in the crude vitamin substance used. It is obviously desirable that as soon as a good protein-free vitamin concentrate is available the above experiments be repeated, using it as a source of the accessory factor."

A test for antiberiberi vitamin and its practical application, C. FUNK and H. E. DUBIN (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 487–498, pl. 1, figs. 3*).—A quantitative method for estimating antiberiberi vitamin is described, and results are reported of its use in testing the relative vitamin content of various substances and the influence of different reagents and procedures on the vitamin content of autolyzed yeast. The technique of the method is as follows:

A yeast suspension is prepared by shaking a loopful of a 48-hour culture of pure yeast in 100 cc. of Nägeli solution on a shaking machine for 3 hours. Three test tubes are then prepared containing, respectively (1) 4 cc. yeast suspension+5 cc. Nägeli+1 cc. water; (2) 1 cc. unknown vitamin solution+5 cc. Nägeli+4 cc. water; and (3) 1 cc. unknown vitamin solution+5 cc. Nägeli+4 cc. yeast suspension. The tubes are incubated for 20 hours at 30° C., after which the fermentation is checked by heating the contents of the tubes to 75° in a water bath for a few minutes. The contents of each tube is then transferred by washing four times with 1 cc. of water into a special centrifuge tube, the bottom of which ends in a capillary 2.5 cm. long and marked in millimeters. The air in the capillary is forced out by a piece of wire and the wire washed

with a few drops of water. The tubes are then centrifuged at about 2,500 revolutions per minute for 15 minutes, after which readings of the sediment in the capillaries are made without delay. The activity of the vitamin in question is measured by the difference in readings of tubes 1 and 3. Tube 2 is an extra control tube and should show no growth. It is stated that the controls with yeast suspensions and Nägeli alone are practically constant at 3.5 mm.

By using varying amounts of autolyzed yeast a standard curve of vitamin activity has been established which, within the limits of 0.01 and 0.1 cc. of autolyzed yeast, is a straight line rising rather abruptly. The flattening out of the curve at higher concentrations is thought to show the presence of inhibiting substances and to indicate that unless factors of inhibition can be removed or inhibited, a quantitative estimation of the vitamin content of any product is impossible. The method is, however, considered of value in approximating the vitamin activity of different preparations and in observing the activity of the same vitamin under various conditions.

The data reported in the use of this test include specificity tests for a number of substances, most of which are confirmatory of results previously obtained by the biological test. A systematic fractionation of autolyzed yeast by successive precipitations with lead acetate, mercuric sulphate, silver acetate, and mercuric chlorid followed by diazotization with nitrous acid and reduction with nitrogen and palladium was carried out with tests of activity at the end of each step. By this process the vitamin activity suffered a loss represented by initial and final readings of 10.5 and 5.5 mm. This is thought to indicate marked stability of the antiberiberi vitamin.

The cause of beriberi on Norwegian ships, A. Holst (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 81* (*1918*), *pp. 56–72*).—An increase in the number of cases of beriberi on Norwegian sailing vessels in the late nineties was found to coincide with three changes in the ship ration in 1894. These consisted in the substitution of tinned meat for the salt meat previously used, a reduction in the weekly ration of vegetables, and the substitution of white bread, often baked without yeast, for the earlier dark bread. It is pointed out that these changes all brought about a reduction in the antineuritic constituents of the ration and were undoubtedly responsible for the increase in the disease.

A few cases are mentioned showing the curative and preventive action in beriberi of beer, eggs, and vegetables.

Pellagra in the mountains of Yancey County, N. C., G. A. Wheeler (*Pub. Health Rpts.* [*U. S.*], *35* (*1920*), *No. 43*, *pp. 2509–2514*).—This is a report of several cases of pellagra occurring in western North Carolina at an altitude of 3,000 ft. or more. The cases appeared to follow the same clinical course as the average of cases at lower altitudes. Indications of a restricted diet, including little or no meat, were manifest in each instance.

The antiscorbutic content of certain body tissues of the rat.—The persistence of the antiscorbutic substance in the liver of the rat after long intervals on a scorbutic diet, H. T. Parsons (*Jour. Biol. Chem., 44* (*1920*), *No. 2*, *pp. 587–602*, *figs. 6*).—In an effort to explain the apparently marked differences in antiscorbutic requirements of the two rodents, the guinea pig and the rat, the antiscorbutic content of the rat's body tissues (1) when a typical scurvy diet was fed and (2) when the diet was high in antiscorbutic substance was tested by feeding extracts of the rat liver and muscle tissues to scorbutic guinea pigs. For purposes of comparison fresh fish tissue was also used.

The liver tissues of the rat showed a high content of the antiscorbutic substance, not only after feeding for a short time on a diet rich in the antiscorbutic substance but also after feeding for a long time on a typical scor-

butic diet, practically no difference in the growth curves of the guinea pigs on the two diets being noticeable. The muscle tissues of the rat could not, with one exception, be fed at an intake high enough to effect a cure in the scorbutic guinea pig. In one case when the intake of the muscle extract reached the equivalent of from 55 to 95 gm. a day the scurvy symptoms were somewhat improved. The water extract of fresh fish muscle tissues equivalent to 35 gm. of the tissue proved incapable of curing scurvy.

These results are thought to indicate the need for the antiscorbutic factor in the normal metabolism of the rat and to suggest the possibility that the rat is capable of synthesizing this factor. Other possibilities suggested and discussed are the utilization by the rat of undemonstrable amounts of the antiscorbutic substance in the food or of a form not available to the guinea pig.

The antiscorbutic requirement of the prairie dog, E. V. McCollum and H. T. Parsons (*Jour. Biol. Chem., 44 (1920), No. 2, pp. 603–607, pls. 2, fig. 1*).—The western prairie dog (*Cynomys ludovicianus*) has been found to resemble the rat rather than the guinea pig in its requirement for antiscorbutic. When fed after weaning on the soy bean scorbutic diet, which is incapable of protecting guinea pigs against the rapid development of scurvy, the young prairie dog is capable of going for at least six months without showing signs of scurvy.

Experiments on carbohydrate metabolism and diabetes.—III, The permeability of blood corpuscles to sugar, M. B. Wishart (*Jour. Biol. Chem., 44 (1920), No 2, pp. 563–586*).—In continuation of the experiments on carbohydrate metabolism by Allen and Wishart (E. S. R., 44, p. 65), a study is reported of the distribution of sugar between blood plasma and corpuscles under a wide variety of experimental conditions, including different quantities and modes of administration of glucose, different degrees of pancreatectomy and diabetes, lipemia, acidosis, exercise, cold, and different levels of the renal threshold. Experiments were made in vitro and in vivo with several animal species.

The concentration of sugar was found invariably to be lower in the corpuscles than in the plasma, the difference between the two tending to increase as the blood sugar rose. The author is of the opinion that the coefficient of distribution of sugar between plasma and corpuscles depends more upon solubility than upon permeability, glucose being more soluble in the plasma than in the corpuscles, perhaps because of the lipoid content of the latter.

"Inasmuch as the sugar content of the corpuscles is subject to considerable irregularities from unknown causes and without known physiological significance, plasma analyses should be preferred to those of whole blood for experimental and clinical purposes."

Clinical characteristics and nutrition in extreme inanition, H. von Hoesslin (*Arch. Hyg., 88 (1919), No. 4, pp. 147–183*).—The author reports clinical observations on a number of extremely emaciated subjects, the victims of prolonged inanition, and also the results of efforts to increase the weight of some of these subjects by various additions to the diet.

It was found that increase in fat or carbohydrate had only a slight influence on the weight, while the addition of only small amounts of protein was followed promptly by increase in weight. An abnormally high retention of nitrogen was the rule whatever the calorific value of the food ingested or its content in nitrogen. Neither carbohydrates nor fats appeared to exert any protein-sparing action.

Some phases of protein catabolism and fatigue, E. L. Scott and A. B. Hastings (*Pub. Health Rpts. [U. S.], 35 (1920), No. 42, pp. 2445–2462, figs. 2*).—The theoretical basis of the study reported was the assumption that an increased sulphur output results from any increase in the rate of cellular respira-

tion. This would involve at a later period the replacement of the desulphurized portion of the protein molecule with amino acids of the necessary structure, while those which had given up their sulphur could not be thus utilized but would be deaminized, utilized as a source of energy, and finally excreted as exogenous amino acids. This is thought to provide a plausible explanation of the delayed nitrogen excretion which follows work.

To determine whether fatigue in industrial workers could be measured by changes in chemical composition of the urine as a result of increased cellular respiration, determinations of total nitrogen, of total sulphur and sulphates, and of total and free phenols were made on the urine of a large number of workingmen in different occupations, and also on men recovering from noncomplicated hernia operations as representing resting controls. Early morning and late afternoon samples of urine were used in both series of experiments. The data obtained are grouped in tables by occupations.

The excretion of total sulphur per gram of nitrogen tended to be greater at night than in the morning in both groups of men, a somewhat greater output being noted in men doing the heaviest work. No increase in the output of sulphate sulphur per gram of nitrogen occurred during the day in men in bed, while there was a marked increase in laboring men proportionate to the severity of the work performed. The proportion of total sulphur eliminated as sulphate tended to increase with severity of exercise. The authors conclude that the severity of any particular form of work may be judged by the ratio of the morning and afternoon sulphate of the urine, provided a sufficient number of determinations are made upon several individuals.

The data obtained in the phenol determinations showed that the ability of the human organism to conjugate phenols is unchanged by moderate muscular effort. Unconjugated phenols were increased slightly by moderate work and to a marked extent by strenuous exercise. This suggests the possibility that free phenol excretion may be an index of severe fatigue. It is pointed out, however, that as phenol production and excretion depend more upon the peculiarities of habit and diet than upon muscular activity, changes in quantity and proportion of phenol excretion can not in general be correlated with increasing severity of occupation.

ANIMAL PRODUCTION.

The rational feeding and breeding of live stock, J. E. Lucas (*L'Alimentation et l'Elevage Rationnels du Bétail. Paris: Libr. Lefrançois, 1920, pp. 466, figs. 2*).—This volume is based upon the lectures given by the late A. Mallèvre in his course in zootechny. Topics discussed include the chemical composition and digestibility of feeds, methods used in the study of nutrition, utilization of feeds for growth, maintenance, and production, importance of water and mineral matter in nutrition, the action of feeds on the organism, preparation of feeds, computation of rations, variation and heredity in domestic animals, and the control of disease. There is also a biography of Mallèvre by G. Wery and a list of his publications.

On the appearance of lactase in the intestine during fetal life, C. Porcher and A. Tapernoux (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 12, pp. 420, 421*).—The author has studied the lactase content of the intestines of 12 bovine fetuses ranging in age from 50 to 175 days. In the case of the youngest individual 17.5 per cent of the lactose in 100 cc. of a 5 per cent solution was hydrolyzed in 2 weeks at 38° C. by 10 cc. of the intestinal fluid. The percentage hydrolyzed increased irregularly with age, and in the case of the four 100-day fetuses observed it varied from 10 to 75. All the lactose was decomposed by the fluid from the oldest specimen.

On the appearance of digestive ferments during fetal life, C. Porcher and A. Tapernoux (*Compt. Rend. Soc. Biol.* [*Paris*], *83* (*1920*), *No. 15, pp. 619, 620*).—The authors report the presence of trypsin, pancreas amylase, pancreas lipase, pepsin, and erepsin in the digestive tracts of three calf fetuses aged 75, 100, and 180 days, respectively.

The fat content of feces of young calves, P. E. Howe (*Amer. Jour. Diseases Children, 21* (*1921*), *No. 1, pp. 57–64*).—The feces of 14 new-born calves were examined daily for about a week. Beginning about the third day the feces contained high proportions of fat and soap. Certain of the calves which did not receive colostrum passed the meconium readily but showed a delayed defecation later.

Castration of cocks during puberty and generalization of the parabolic law of retrogression, A. Pézard (*Compt. Rend. Acad. Sci.* [*Paris*], *171* (*1920*), *No. 22, pp. 1081–1083*).—The author reports the lengths of combs of 7 cocks castrated before the comb reached its full development, thus supplementing the data on postpubertal castration previously noted (E. S. R., 38, p. 170; 40, p. 871).

In the young birds, as in the older ones, it was found that the length of comb L at time t after castration is given approximately by the formula

$$L=l+\tfrac{1}{2}c(\theta-t)^2,$$

where l is the final length and θ the duration of retrogression. The quantity c is to be calculated by the equation for each bird and indicates the (negative) acceleration of comb growth. When all the capons are arranged in order of initial comb length (i. e., in order of approximate age at castration), it is evident that c decreases and θ increases with age, while the product $c\theta$ does not vary systematically with age and is interpreted as constant.

Numerical law of regression of certain secondary sex characters, A. Pézard (*Jour. Gen. Physiol., 3* (*1921*), *No. 3, pp. 271–283, figs. 9*).—The author reports additional details of the castration experiments noted above, and repeats the derivation of the so-called parabolic law of retrogression of comb.

The all-or-none law or the law of functional constancy in relation to the action of the testicle considered as an endocrine gland, A. Pézard (*Compt. Rend. Acad. Sci.* [*Paris*], *172* (*1921*), *No. 1, pp. 89–92*).—The author reports observations on the comb length and the condition of the testicular tissue in 7 normal cocks, 7 capons, and 12 male fowls carrying pieces of testicular tissue that had been implanted in the peritoneum after castration. Eight of the latter had combs typical of cocks, but the pieces of implanted tissue ranged in weight from 0.5 to 2 gm., whereas the testes of the normal individuals weighed from 8.3 to 42 gm. In 4 birds the implanted tissue weighed 0.1 gm. or less, and in these cases the combs were no larger than the combs of the true capons. It is concluded that in normal males only a small fraction—say 2 per cent—of the testicular hormone is used to maintain the secondary sexual characters, the remainder being what E. Gley calls the luxus secretion.

Latent periods in experiments in testicular transplantation and the all-or-none law, A. Pézard (*Compt. Rend. Acad. Sci.* [*Paris*], *172* (*1921*), *No. 3, pp. 176–178, fig. 1*).—The author reports observations on 7 castrated cocks in whose peritoneal cavities pieces of testicular tissue had been implanted.

In one case the implanted tissue was of large size, and the comb did not show retrogression toward the capon type. In the other cases the implanted tissue was small, and there was a retrogressive period of 2 to 6 months before the comb started to grow again. It is thought that this latent period is equal to the time necessary for the implant to attain a mass of 0.5 gm., which the author calls the morphological threshold.

Geographic variation and Mendelian inheritance, F. B. Sumner (*Jour. Expt. Zool., 30 (1920), No. 3, pp. 369–402, figs. 7*).—The author reports failure to secure clear evidence of segregation of quantitative characters (skeletal measurements, intensity of pigmentation, etc.) in crosses between geographical races of the deer mouse (*Peromyscus maniculatus*).

Inheritance studies on mice, I, II, L. Plate (*Arch. Entwickl. Mech. Organ., 44 (1918), No. 2, pp. 291–336, pl. 1, figs. 5*).—Two papers are presented, as follows:

I. *The inheritance of sable coat color in domestic mice as an example of a progressive mutation* (pp. 291–317).—Breeding experiments with mice are reported which are held to show that sable (Y') belongs to the same set of allelmorphs as yellow (Y) and nonyellow (y). The types Y' Y' and Y' Y are not viable. Whether Y' is epistatic to Y can not, therefore, be directly determined, but from other considerations the author thinks that Y' arose from Y as a progressive mutation.

Dark, medium, and light sables are recognized, the differences depending in part on the presence of the black factor. Dark sables get lighter as they grow older, and this change is more rapid in individuals heterozygous for pink-eye than those homozygous for normal eye color.

II. *The inheritance of white spotting in mice and its explanation by polymerous factors* (pp. 318–336).—The author uses the theory of multiple factors to account for the variation in the amounts of recessive white spotting exhibited by mice not carrying the self factor. Six grades of spotting are recognized.

The length of life of domesticated and wild animals, R. Disselhorst (*Kühn Arch., 7 (1918), pp. 169–189*).—This is a collection of data as to the length of life of cattle, sheep, and horses, and a summary of information about the length of life of wild animals born in zoological gardens.

The number of purebreds on farms, G. M. Rommel (*Breeder's Gaz., 79 (1921), No. 7, pp. 314, 315, fig. 1*).—This is a summary of preliminary returns of the 1920 census showing the number and proportion of purebred stock in 10 States. Hitherto exact data on the number of purebreds have not been available.

Review of the frozen meat trade, 1920, W. Weddel & Co., Ltd. (*Weddel's Ann. Rev. Frozen Meat Trade, 33 (1920), pp. 26, pl. 1*).—A statistical summary of the British import trade in beef, mutton, and lamb carcasses during 1920, with comparative data for previous years and other countries.

Reseeding the range, A. W. Sampson (*Natl. Wool Grower, 11 (1921), No. 4, pp. 11–13, figs. 4*).—This is a survey of some of the range management studies conducted by the Forest Service, U. S. Department of Agriculture, at the Great Basin Experiment Station, Ephraim, Utah. They concern the correlation between leaf development of trees and the suitability of the undergrowth for grazing, the relationship between the yield of forage and intensity of grazing, the recognition of overgrazing by changes in vegetation, and the "deferred and rotation" grazing system of reseeding.

Food value of willow leaves, T. D. Hall (*Union So. Africa, Dept. Agr. Jour., 1 (1920), No. 5, pp. 456, 457*).—Proximate analyses of willow leaves (with some twigs) are reported. It is stated that these leaves are sought after by range cattle early in the spring. The moisture content averaged 67.6, crude protein 5.4, and crude fiber 7 per cent. Analyses of the ash showed high proportions of calcium and magnesium.

Silage investigations [at the Oregon Experiment Station] (*Oregon Sta. Rpt. 1919–20, p. 22*).—Samples of corn and of sunflowers ensiled in jars without treatment were found to develop as much acid as similar samples in-

oculated with *Bacterium lactis acidi*. Inoculated jars closely packed showed greater acid development than loosely packed ones.

Comparative investigations of the composition and digestibility of peace-time and war-time wheat bran and rye bran, F. HONCAMP and O. NOLTE (*Landw. Vers. Sta., 96 (1920), No. 3–4, pp. 121–142*).—The authors report digestion trials with sheep fed wheat bran or rye bran in conjunction with meadow hay and brewers' dried yeast. The peace-time brans represented a 75 per cent flour extraction in the case of wheat and a 65 per cent extraction in the case of rye. The extraction was higher for the war-time brans. The following table summarizes the main results:

Influence of flour extraction on the composition and digestibility of bran.

Kind of bran.	Flour extraction.	Composition of bran (dry basis)				Digestibility of bran.				
		Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Organic matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Wheat	75	17.02	4.61	7.72	65.62	77.2	84.4	87.8	27.6	80.5
Do	83	17.32	5.08	9.31	62.18	73.8	81.9	84.4	40.1	75.5
Do	94	15.28	4.28	13.10	62.62	51.9	72.1	80.7	37.3	48.1
Rye	65	15.51	3.30	3.46	74.14	84.0	77.9	76.7	59.4	86.7
Do	84	16.39	3.87	4.33	70.50	80.0	78.0	77.9	41.2	85.7
Do	94	19.04	4.99	10.62	57.87	55.5	78.0	79.5	55.5	46.2

Feeding cottonseed products to live stock, E. W. SHEETS and E. H. THOMPSON (*U. S. Dept. Agr., Farmers' Bul. 1179 (1920), pp. 18, figs. 4*).—This is a review of the composition and classification of cottonseed products and their use in stock feeding. The precautions necessary to avoid cottonseed meal poisoning are indicated.

The feeding value of dried yeast on the basis of nutrition and fattening experiments with sheep and swine, F. HONCAMP (*Landw. Vers. Sta., 96 (1920), No. 3–4, pp. 143–206*).—Digestion trials of four proprietary preparations of brewers' dried yeast are reported.

There were marked differences between the preparations. For example, the digestibility of the organic matter ranged from 66.4 to 90.7 per cent in the case of sheep and from 53 to 94.8 per cent in the case of pigs. With three preparations the digestion coefficients were systematically higher for pigs than for sheep.

Feeding experiments conducted in 1911 and 1912 were also reported. Dried yeast fed to sheep in conjunction with corn meal, rye meal, and clover hay was compared with soy bean meal and mixtures of sesame cake and cottonseed meal. For pigs the yeast was compared with fish meal as a supplement to ground barley and skim milk. In all cases the yeast compared favorably with the other supplements tested, and it is considered particularly valuable for swine since no crude fiber was found in the samples analyzed.

The digestibility of sorghum mill refuse, A. C. MCCANDLISH (*Jour. Dairy Sci., 3 (1920), No. 5, pp. 367–369*).—A 5-day digestion trial with 2 cows at the Iowa Experiment Station showed that sorghum mill refuse had the following average digestion coefficients: Dry matter 33.4, crude fiber 47.1, and nitrogen-free extract 34.7. The material itself contained 73.1 per cent moisture, 11.5 per cent crude fiber, 13 per cent nitrogen-free extract, and less than 1 per cent of protein and fat. The net energy value computed by the Armsby-Fries method was found to be only 6.5 therms, which is said to be a lower value than that reported for any recognized feed.

The digestibility of corn cannery refuse, A. C. McCandlish (*Jour. Dairy Sci., 3 (1920), No. 5, pp. 370–374*).—Corn cannery refuse, partially fermented and consisting mainly of sweet corn husks, was fed to the cows that were used in the digestion trial noted above. The material consisted of 83.3 per cent moisture, 1.32 per cent crude protein, 5 per cent crude fiber, and 9.2 per cent nitrogen-free extract. The digestion coefficients during a 5-day period were as follows: Dry matter 31.9, crude protein 7.7, crude fiber 24.4, and nitrogen-free extract 39.9. It is estimated that 1 ton of corn cannery refuse fed with 5 bu. of corn would have approximately the same value as a ton of good corn silage.

Rations for fattening steers, J. C. Burns (*Texas Sta. Bul. 263 (1920), pp. 3–19, figs. 4*).—This is the report of three feeding trials with steers, the object being to compare cottonseed products with peanut products as protein supplements and sorghum silage with cottonseed hulls as a roughage.

The first experiment was begun September 11, 1916, and lasted 179 days. There were two lots of 17 2-year-old grade Angus steers. Both received the same roughage ration, corn or sorghum silage (averaging 19.11 lbs. per head daily), Bermuda hay (2.55 lbs.), and cottonseed hulls fed toward the end of the experiment (0.85 lb.). Lot 1 received 3.25 lbs. of cottonseed meal and 11.05 lbs. of ground milo per head daily and made an average daily gain of 2.09 lbs. Lot 2 averaged 2.71 lbs. of peanut meal and 11.59 lbs. of ground milo and made a daily gain of 2.15 lbs. The peanut meal proved less palatable than the cottonseed meal. Lot 1 dressed out 64.76 per cent and lot 2, 64.3 per cent.

The second experiment was conducted with 41 yearling Hereford grade steers divided into two lots and began September 8, 1916, and lasted 182 days. The steers in both lots received 16.94 lbs. of silage, 1.77 lbs. of Bermuda hay, and 0.73 lb. of cottonseed hulls per head daily. The grain ration for lot 1 averaged 4.67 lbs. of cold pressed cotton seed and 8.44 lbs. of ground milo, while lot 2 received 3.5 lbs. of ground whole pressed peanuts and 9.6 lbs. of ground milo. Lot 1 gained 2.24 lbs., and lot 2 gained 2 lbs. per head daily. The carcasses of lot 1 were somewhat heavier and showed better finish than those of lot 2.

The third experiment was made with two lots of 30 yearling Hereford steers. It began November 4, 1919, and lasted 120 days. The concentrates fed were the same in both cases, cottonseed meal, corn or milo, and blackstrap molasses. Lot 1 was to have received cottonseed hulls as sole roughage, but toward the end of the test some of the animals went off feed and a little sorghum silage was added. The average daily ration was 10.76 lbs. of the hulls and 2.14 lbs. of the silage. Lot 2 was given 13.93 lbs. of silage and 7.12 lbs. of hulls. The respective average daily gains were 2.26 and 2.24 lbs. per head.

Range cattle management in the Philippines, B. M. Gonzalez (*Philippine Agr., 9 (1920), No. 3, pp. 59–65*).—The author considers the problems of grassland management in the Philippines and the care of range cattle. The predominant grass is cogon (*Imperata cylindrica*). Shelters are seldom necessary, and the difficulty of securing labor to handle the manure makes it undesirable to corral the cattle at night. It is stated that Indian cattle are readily acclimated and are resistant to ticks and rinderpest. European breeds are more difficult to keep in good health. Suggestions for subdividing a large herd to facilitate selection of breeding stock for herd improvement are included.

Experiments in breeding fine wool sheep, F. R. Marshall (*Natl. Wool Grower, 10 (1920), No. 4, pp. 15–18*).—The author reports some of the results of sheep breeding experiments conducted in Wyoming and Idaho by the Bureau of Animal Industry of the U. S. Department of Agriculture (E. S. R., 42, p. 869).

Data are tabulated showing the relationship between length of wool, weight of fleece, and fineness of wool in grade Rambouillet range ewes. It is con-

cluded that selection for long wool would increase the weight of fleece, and that such selection would be rapidly effected if less emphasis could be placed on fineness of wool. It was also found that the fleeces of ewes with much wool on the face were not systematically heavier than fleeces from open-faced ewes, and that the ewes themselves were often lighter in weight.

Problems of sheep breeding.—II, Contributions to the study of wool and the judging of sheep, R. HEYMONS ET AL. (*Arb. Deut. Landw. Gesell., No. 306 (1920), pp. VII+128, pls. 22*).—This publication continues one previously noted (E. S. R., 43, p. 570), and includes the following papers: Wild Sheep and Domestic Sheep, by R. Heymons (pp. 1–16); Significance and Fundamentals of the Study of Wool, by C. Lehmann (pp. 17–60); Racial Relationships, Body Forms, and Wool Quality of Sheep, by W. Völtz (pp. 61–122); and The Aim of German Sheep Breeding, by [G.] Freyer (pp. 123–128). Lehmann's paper covers the histological structure of the skin and wool, the judging of fleeces, and the sorting of wool.

Sheep and wool for farmers.—Cross-breeding experiments.—Results of lamb-raising trials, J. W. MATHEWS (*Agr. Gaz. N. S. Wales, 31 (1920), Nos. 11, pp. 761–770, fig. 1; 12, pp. 846–852, pls. 3*).—This paper is based upon seven years' records at the Wagga, Cowra, and Bathurst Experimental Farms of tests of short-wool rams as producers of lambs whose carcasses are designed for export, and continues similar experiments with long-wool rams previously noted (E. S. R., 42, p. 869). The rams used were Southdown, Shropshire, and Dorset Horn, and the ewes Lincoln×Merino, Leicester×Merino, and Border Leicester×Merino.

The Dorset Horn rams, although slightly inferior to the Southdowns in percentage of lambs produced and raised, furnished the heaviest carcasses and were the most profitable. Lambs from the Southdown rams furnished the best quality of mutton. The Border Leicester×Merino ewes produced somewhat more satisfactory lambs than the other ewes.

Raising sheep on temporary pastures, F. R. MARSHALL and C. G. POTTS (*U. S. Dept. Agr., Farmers' Bul. 1181 (1921), pp. 3–18, figs. 7*).—The authors outline the advantages of annual crops as pastures in specialized sheep farming and describe the system in use at the U. S. Experimental Farm, Beltsville, Md., where sheep are put on wheat or rye early in April and in the course of the summer and fall graze alfalfa, oats and peas, rape, soy beans, and corn and velvet beans in succession. Each acre in the 30-acre field provides on an average 250 days' grazing for two sheep. The sheep are not kept on a particular area for more than two weeks at a time, and it is found convenient to have the separate plats relatively narrow to facilitate subdivision of the pasture by means of short movable fences.

Tests in winter feeding of lambs, T. W. LONSDALE (*New Zeal. Jour. Agr., 21 (1920), No. 4, p. 203*).—Four lots of 20 60-lb. lambs each were fed on pasture for two months beginning May 25, 1920. The lot receiving swedes and chaffed pea straw (the standard supplementary feeds) gained 11.5 lbs. per head. The lot receiving alfalfa hay gained 11.1 lbs., the lot receiving ordinary hay 10.7 lbs., and the lot receiving no extra feed 10.2 lbs.

Lamb fattening, O. RIVERS (*Union So. Africa, Dept. Agr. Jour., 1 (1920), No. 5, pp. 458–462, figs. 3*).—A lot of 32 49-lb. lambs grazed for 10 weeks on Algerian oats and fed a grain ration of corn meal, wheat bran, and crushed oats, made an average gain of 35.9 lbs. and consumed 26.6 lbs. of grain per head. A check lot of 17 44-lb. lambs, receiving no grain, but pastured on oats and alfalfa alternately, gained 27.2 lbs. per head. Considering the cost of the grain and the labor of grinding, it is concluded that pasture without grain gave the greater profit.

Further inbreeding experiments with many-horned goats, R. Müller (*Arch. Wiss. u. Prakt. Tierheilk., 44 (1918), Sup., pp. 198–206, figs. 9; also in Deut. Landw. Tierzucht, 25 (1921), No. 2, pp. 13, 14, figs. 9*).—The author reports a continuation of the breeding experiments previously noted (E. S. R., 28, p. 370). A buck bearing 8 horns—the largest number thus far observed—was produced by mating a brother and sister, both 4-horned with 4-horned unrelated parents. This buck produced a 7-horned kid when mated to his dam and a 5-horned kid when mated to a 2-horned doe whose sire was 5-horned.

Results of a Mendelian experiment on fowls, including the production of a pile breed, J. T. Cunningham (*Zool. Soc. London Proc., 1919, I–II, pp. 173–202, pl. 1*).—The author lists the characteristics of about 150 offspring in generations F_2 to F_6 of a Jungle Fowl ♂ × Silky ♀ cross, recording for each individual the color of plumage and skin, and the character or development of the plumage, comb, crest, fifth toe, and toe feathering. Except in the case of plumage color, the discussion adds little to the conclusions drawn in a previous paper[1] dealing with the F_1 and F_2.

In the early generations the significance of traces of yellowish pigment on the recessive "white" chicks was not appreciated, and many of these, particularly as it happened the females, were discarded before the juvenile molt. Later it became apparent that most, if not all, such birds when adult develop the pile pattern, i. e., show white only on those parts of the body—the breast (in the case of males), back, tail, flights, etc.—which are black in Black-breasted Red varieties. The cocks have diffuse yellow color elsewhere, but in the hens the color tends to be reddish brown. Evidence from the experience of fanciers is cited to show that the pattern of the Pile variety of the English Game is dominant to that of the Black-breasted Red Game.

Broodiness in domestic fowl.—Data concerning its inheritance in the Rhode Island Red breed, H. D. Goodale, R. Sanborn, and D. White (*Massachusetts Sta. Bul. 199 (1920), pp. 93–116, figs. 4*).—A study of the records of broodiness in the pullet year of the Rhode Island Red flock at the station showed that the hypothesis of a single dominant factor for broodiness is not tenable. The observed ratios are very close to expectation, however, when it is assumed that two factors (designated *A* and *C*) must both be present if broodiness is exhibited. One exceptional case is explained by assuming a dominant modifying factor (designated *N*) that inhibits broodiness. There are thus genetically at least four types of nonbroodiness and only one type of broodiness. It is suggested that birds showing only a slight tendency to broodiness belong in the same class as the nonbroody birds, since about the same proportion of broody offspring are produced by each class. The determination of broodiness is complicated by the fact that birds which are not broody during the pullet year may become broody in the second or third year.

It was found possible to reduce the amount of broodiness considerably by selection. In the season of 1912–13 before selection began the average hen was broody 3.88 times a year, while in 1917–18 the average was only 0.36. A study of the correlations between broodiness and egg laying indicated that pullets that are very broody tend to lay relatively few eggs between broody periods. Birds which laid most heavily had short broody periods.

Factors which influence winter egg production, B. F. Kaupp (*Poultry Item, 22 (1920), No. 5, pp. 5, 6, fig. 1*).—The author cites data collected at the North Carolin Experiment Station showing (1) that winter egg records of Single Comb Rhode Island Red pullets were improved by artificial lighting, and (2) that a "hot supper" (shredded mangels, cabbage, etc., plus the regu-

[1] Zool. Soc. London Proc., 1912, II, pp. 241–259.

lation mash) daily at 4 p. m. from November 1 to March 31 was not definitely superior to the standard dry mash.

How to hatch more and better chicks, E. H. WENE (*New Jersey Stas., Hints to Poultrymen, 9 (1921), No. 5, pp. 4, fig. 1*).—Suggestions for the management of incubators.

Effect of moisture on hatching (*Oregon Sta. Rpt. 1919–20, pp. 26, 27*).—The humidity in incubators was studied by means of the wet-bulb thermometer. When the thermometer registered 88° the hatch was about 30 per cent greater than at 85° and the chicks were also heavier. The embryo utilized more of the lime from the shell when the humidity was high.

Poultry keeping in Porto Rico, H. C. HENDRICKSEN (*Porto Rico Dept. Agr. Sta. Circ. 19 (1921), pp. 22, figs. 14*).—This is mainly a description of the improved breeds of poultry that are considered suitable for Porto Rico and suggestions as to the management of the flock.

Egg and live poultry markets before and after the war, B. F. KAUPP (*Poultry Item, 23 (1920), No. 2, pp. 6, 7, figs. 3*).—Charts are presented showing the monthly prices of eggs and broilers in North Carolina during 1915 and 1919.

DAIRY FARMING—DAIRYING.

[Feeding experiments with dairy cattle at the Oregon Experiment Station] (*Oregon Sta. Rpt. 1919–20, pp. 22–24*).—Several feeding experiments with cows and heifers are mentioned briefly.

In a comparison of silages it was found that a sudden change from oat-and-vetch silage or corn silage to sunflower silage threw the cows off feed, and the sunflower silage was not consumed as readily as the others. In two experiments with cows, mill run (bran and shorts) was compared with barley, and cottonseed meal was compared with coconut meal, but marked differences in feeding value between the materials compared were not discovered.

In a study of winter rations for growing heifers it was found that a ration of wheat straw and molasses plus limited amounts of mill run and coconut meal produced satisfactory growth and was much cheaper than clover hay. Heifers fed 6 lbs. of clover hay per day and unlimited amounts of sunflower or corn silage made an average daily increase of 0.133 cm. in height at withers and a daily gain in weight ranging from 0.25 to 0.7 lb. per head.

The efficiency of milk substitutes in calf feeding, G. SPITZER and R. H. CARR (*Jour. Dairy Sci., 3 (1920), No. 5, pp. 315–339, figs. 6*).—This paper consists of (1) a summary in convenient form of the metabolism studies with calf meals reported by Caldwell (E. S. R., 42, p. 471), giving 90-day averages for each calf, (2) a report of a similar study of Purdue calf meal, and (3) a more detailed account than that given in Indiana Station Bulletin 246 (E. S. R., 43, p. 875) of a practical feeding test of the Purdue calf meal.

The Purdue calf meal is composed of corn meal, linseed meal, beef blood, and steamed ground bone. The blood is added in the liquid form, and the whole is slowly dried at a relatively low temperature (140 to 160° F.). Metabolism studies of this meal were made with 2 grade Holstein calves about 2 weeks old, which in addition to the calf meal received as much ground corn, and linseed meal (8:1) and chopped corn fodder as they would eat. Of the nitrogen ingested, 39.1 per cent was retained and 26.8 per cent was eliminated in the urine.

In the case of Caldwell's liquid blood ration, 24.5 per cent of the ingested nitrogen was retained and 45.8 per cent was excreted in the urine. The results with the Purdue meal are considered very close to the results from Caldwell's milk ration, in which 42.3 per cent of the ingested nitrogen was

retained and 31.1 per cent appeared in the urine. In the case of Caldwell's clover hay ration, 32 per cent of the nitrogen was retained and 27.3 per cent was recovered in the urine.

Report on control societies and cow test associations for the year 1918–19, K. Saareim (*[Norway Landbruks Dept.] Landbruks Direkt. Ber. Tillegg O, 1920, pp. 41*).—This report consists mostly of a summary of cost accounting data collected on individual dairy farms in Norway. The amounts of different feeds and the number of feed units required to produce 100 kg. of milk are tabulated, as well as the feed consumption of calves to the age of 2 years.

Grain and butter prices and butter fat production, A. J. McGuire (*N. Y. Prod. Rev. and Amer. Creamery, 51 (1920), No. 8, pp. 370–372*).—The author cites farm prices of corn and oats during the years 1910–1919, the average prices paid for butter fat by cooperative creameries in Minnesota, and the prices of butter extras on the New York market. The creameries paying the highest price for butter fat were those with a large volume of business and receiving a high-grade of cream.

On the formation of milk sugar in the mammary gland, F. Röhmann (*Biochem. Ztschr., 93 (1919), No. 3–4, pp. 237–252*).—Protocols are presented of 11 experiments in which the mammary glands were removed from cows after death and extracted with hot water, chloroform, etc. The changes occurring in the chemical and optical properties of the extracts on successive days were observed.

The conclusion is drawn that the *d*-glucose supplied by the blood stream is generally stored for a time as an unknown intermediate product which acts as a buffer. When needed it is reconverted into *d*-glucose by fermentation of an unknown nature, and is then transformed into *d*-fructose and *d*-galactose and eventually into lactose by the action of enzyms known to be present in the gland. Tests showed that the reformation of *d*-glucose is not a glucosid hydrolysis.

An associative study of Streptococcus lacticus and Bacillus subtilis in milk, M. S. Marshall (*Jour. Dairy Sci., 3 (1920), No. 5, pp. 406–413, figs. 4*).—From studies at the Massachusetts Experiment Station in which *S. lacticus* and *B. subtilis* in different proportions were grown together in milk, it is concluded that the presence of *B. subtilis* stimulates the acid fermentation of *S. lacticus*. A high concentration of *B. subtilis* promotes acid production in the earlier stages of the culture, while a relatively low concentration favors acid production later.

Farmer's manual for the production of clean milk, C. E. North (*Manual del Agricultor par la Producción de Leche Limpia. New York: John Wiley & Sons, Inc., 1921, pp. X+133, figs. 71*).—This is the Spanish edition of a volume previously noted (E. S. R., 42, p. 472).

Pasteurization of milk, H. A. Whittaker et al. (*Boston: Amer. Pub. Health Assoc., 1920, pp. 32*).—This report of the committee on milk supply of the Sanitary Engineering Section of the American Public Health Association deals with the present status of pasteurization, its effect on the composition of milk, and the operation, control, and official supervision of pasteurizing plants. The discussions of the mechanical construction of the plants and the bacteriological control of pasteurization are particularly full.

Experiments by two members of the committee, H. D. Pease and S. M. Heulings, are reported briefly. They inoculated milk with large numbers of pathogenic organisms, particularly *Bacillus typhosus*, *B. diphtheræ*, and *B. tuberculosis*, and then pasteurized it. None of the pathogenic organisms survived heating to 141° F. and holding for 30 minutes, but some of the *B. coli* occurring in the raw milk were still alive, and it is concluded that the *B. coli*

determination is a useful index of the efficiency of pasteruization. The committee considers the holding system the only safe system of pasteurization, the temperature to be not lower than 145° for at least 30 minutes.

It is stated that there are about 4,200 pasteurization plants in operation in the United States and Canada, and that very few of these installations are controlled from a public health standpoint. The wide diversity in the legal meaning of "pasteurized milk" in different localities is deplored.

A modified Babcock method for determining fat in butter, N. W. HEPBURN (*New York Cornell Sta. Mem. 37 (1920), pp. 669–690*).—This is a comparison between two types of Babcock bottles for determining the fat in butter, a 9-in. bottle designed to hold a 9-gm. sample and a 6-in. bottle for a 6-gm. sample. In the former the graduations on the neck extended over 139 mm. and the neck was 9.07 mm. thick. In the latter the graduated part of the neck was 93.5 mm. long and the diameter was 9.04 mm.

Parallel determinations of the fat in 124 samples of butter by means of the Official method and the two bottles are tabulated. The accuracy was judged by determining the correlation between the readings on the bottles and the results of the Official analysis. The 6-in. bottle proved slightly more accurate than the 9 in., but the differences were so small and both came so close to the determinations by the Official method that the difference is not considered important. The use of the 9-in. bottle is recommended because of the greater ease in manipulation.

A bacteriological and biochemical study of experimental butters, C. W. BROWN, L. M. SMITH, and G. L. A. RUEHLE (*Jour. Dairy Sci., 3 (1920), No. 5, pp. 375–405*).—This is a report of an experiment conducted at the Michigan Experiment Station in 1909–10.

A total of 3,954 lbs. of cream received the same day was divided into 4 equal lots treated as follows: (1) Churned at once, (2) pasteurized and churned immediately after cooling, (3) ripened with starter over night and churned raw, and (4) pasteurized, ripened with starter over night, and then churned. Each of these lots was divided into 10 sublots, 2 of which were churned normally as controls, 2 had the second wash water acidified with lactic acid, 2 had powdered casein worked into the butter, 2 had fishy butter worked in, and 2 had powdered boric acid worked in. At various intervals during storage samples were withdrawn for analysis as to moisture, salt, lactose, nitrogen, and acidity, and for determinations of the bacterial count and the kinds of organisms present.

The raw cream butters quickly developed an "old cream" flavor which was later followed by a fishy flavor, and a tallowy flavor was also frequently developed. Metallic and acrid flavors developed frequently in the butters from ripened pasteurized cream. The stored butters showed a slow gradual decrease in the amount of lactose present and a gradual increase in the acidity, although the two changes were not inversely proportional to each other. The pasteurized cream butters contained about twice as much nitrogen as the raw cream butter.

The bacteriological studies revealed relatively high counts in butters over a year old. The lactic acid bacteria were found to be still noticeable after 275 days' storage, and in one case they were found after 420 days' storage. The lactic acid bacteria were gradually replaced by a more miscellaneous flora, among which the predominating types were a species of Oïdium, a liquefying yeast, and a nonliquefying yeast. The first two occurred only rarely in pasteurized-cream butters.

Twelve typical organisms from the butter were studied with regard to their tolerance to 5 per cent salt in milk. In only one case was growth retarded.

No general conclusions are drawn from the differences between the variously treated sublots, but the determinations made on each are tabulated.

Notes on yeast and mold counts of creamery butter, 1919, T. H. LUND (*Dairymen's Assocs. Ontario Ann. Rpts., 1919, pp. 90–94*).—Continuing the work already noted (E. S. R., 42, p. 674), the author reports counts of yeasts, *Oïdium lactis*, and Penicillium on 95 samples of butter from 10 creameries. The Oïdium and yeast counts were high in butter from the 2 creameries where the cream was not pasteurized, and samples from one of these creameries contained numerous Penicillium colonies. Pasteurization as practiced in some of the other plants was either not effective in reducing the yeast counts or else recontamination occurred.

Yeasts and molds in pasteurized cream butter, T. H. LUND (*N. Y. Prod. Rev. and Amer. Creamery, 51 (1921), No. 11, pp. 510, 511*).—Counts of yeasts and molds in samples of butter entered in the 1920 Dominion scoring contest and in samples of butter from Ontario creameries in the summer of 1920 are reported.

The Storch test indicated that each of the samples had been pasteurized. Less than 10 colonies of *Oïdium lactis* per cubic centimeter were found on 63.5 per cent of the Dominion and 70 per cent of the Ontario lots. The yeast counts were high, particularly in the contest lots, where nearly 70 per cent contained over 5,000 per cubic centimeter. The yeast counts are attributed largely to recontamination in the churn, "the most insanitary piece of apparatus found remaining in a modern creamery."

Pure culture starter.—Its use in cheesemaking, J. M. SHERMAN (*N. Y. Prod. Rev. and Amer. Creamery, 51 (1921), No. 18, pp. 860, 862*).—In this address the speaker discussed the practical results of recent work of the Dairy Division of the U. S. Department of Agriculture in making Swiss cheese by the use of *Bacillus bulgaricus* starter and a culture of an organism that produces the characteristic holes. Rennet extract and not homemade rennet is to be used with these cultures.

Improved methods of manufacturing Swiss cheese, C. M. GERE (*Butter, Cheese, and Egg Jour., 12 (1921), No. 7, pp. 26–30, 32*).—This address covers the same ground as that of Sherman noted above.

VETERINARY MEDICINE.

[Report of the] department of veterinary medicine (*Oregon Sta. Rpt. 1919–20, pp. 27–30*).—This is a brief statement of work conducted during the fiscal years 1919 and 1920, which was centered on diseases of cattle, mainly infectious abortion.

The abortion investigations have led to the conclusions that infected milk may be fed to young heifers with very little danger of their becoming infected, that there is very little danger of spreading the disease through breeding negative females to negative bulls which have served positive females, or in spreading the disease through pen exposure of unbred heifers, and that the common and most serious method of spread of the disease is through pen exposure of pregnant animals. Investigations of sterility in breeding cattle, of vaginitis and balanitis, and of miscellaneous work are also briefly noted.

The narrow-leaved milkweed (Asclepias mexicana) and the broad-leaved or showy milkweed (A. speciosa), plants poisonous to live stock in Nevada, C. E. FLEMING, N. F. PETERSON, ET AL. (*Nevada Sta. Bul. 99 (1920), pp. 32, figs. 10*).—This is a report of feeding tests and observations which have shown that *A. mexicana* and *A. speciosa*, both of which occur commonly in Nevada, are

poisonous to sheep and cattle, and that the heart-leaved milkweed (*A. cordifolia*) and the prostrate milkweed (*A. cryptoceras*) are not poisonous enough or common enough to be dangerous on the range or in pastures in Nevada.

The symptoms of poisoning in sheep caused by *A. mexicana*, which is by far the most important of the two species, occur about five to seven hours after artificial or natural feeding of the leaves or the whole plant. Five oz. of the dried plant appeared to be the minimum quantity producing symptoms of poisoning in sheep. Three lbs. of the dried leaves appeared to be the minimum quantity producing toxic symptoms in a 250-lb. calf, with subsequent recovery.

The first noticeable symptoms in either cattle or sheep poisoned by the narrow-leaved milkweed are general depression, refusal to eat, and unsteady, wobbly gait. "The unsteady gait is due to partial paralysis of the hind limbs. Occasionally the paralysis is confined to only one limb. This causes an incoordination in movement, and the animal sways from side to side. Marked muscular trembling is sometimes observed, and in a few hours the animal lies down, refusing to arise. During the period of recumbency tetanic spasms (rigid extention) of the limbs occur at intervals of two or three minutes. There is no perceptible elevation of temperature. The pulse rate increases with the duration of the attack and shortly before death may attain the rate of 180 per minute, becoming very thready. Breathing is labored and rapid. The head is extended backward and quite rigid. The attack may persist for 24 hours, and immediately before death the animal lies in a semicomatose state. In case affected animals recover, the gait is unsteady for two or three days. In some cases incoordinate movements of the hind limbs persist as long as one week after the other symptoms have disappeared.

"Animals poisoned by the broad-leaved or showy milkweed stop eating, grow dull, and lie down; the breathing is irregular, difficult, and grunting. There are no spasms. The breathing becomes more difficult, and the animals die quietly." The post-mortem lesions are reported upon. An examination made of a portion of the narrow-leaved milkweed material used in the feeding experiments gave results which were in some ways similar to those which have been reported for *A. galioides* (E. S. R., 43, p. 470). A small quantity of the plant was extracted successively with solvents, and the amounts extracted by each were as follows: Benzol 10.55 per cent, ether 0.64, chloroform 0.7, ethyl acetate 2.68, and alcohol 0.46 per cent. Residues from these extractions administered to guinea pigs by mouth, in amounts corresponding in each case to 5 gm. of the dry plant, all appeared to be nontoxic, except the benzol extract. Tests with the general alkaloidal reagents indicated the presence of alkaloids.

"It is a costly and difficult matter to get rid of the narrow-leaved milkweed on even a small piece of ground. If a bit of the underground stem is left in the soil, it will soon produce a new plant. Both of our poisonous milkweeds have so unpleasant a flavor that neither sheep nor cattle will eat them, except when they are very hungry and there is practically nothing else in the field for them to eat. Poisoning may be prevented by keeping hungry animals and animals in poor condition away from milkweed patches, and by stocking pastures lightly enough to keep the animals constantly provided with other food."

The life histories of Dictyocaulus filaria (Rud.) and D. viviparus (Bloch), R. DAUBNEY (*Jour. Compar. Path. and Ther., 33 (1920), No. 4, pp. 225–266, figs. 12*).—**This is a report of work carried on at the laboratories of the Zoological Division of the Bureau of Animal Industry, U. S. Department of Agriculture. It includes a bibliography of 44 titles. The results have been summarized as follows:**

"Under suitable conditions, the eggs of *D. filaria* and *D. viviparus* hatch and liberate embryos which do not feed or grow, but undergo a molt in the course of 1 or 2 days, retaining the old cuticle. A second molt occurs in from 12 to 48 hours after the first molt. The larvæ retain the skin of both molts. Completion of the first molt (i. e., casting of the first cuticle) occurs 12 to 48 hours after the second molt. The larvæ retain the cuticle of the second molt. The final-stage larvæ, i. e., those which have completed the first molt, migrate under favorable conditions of temperature and moisture to upright objects, such as the walls of jars, blades of grass, etc. The final-stage larvæ possess a high degree of resistance to cold and to drying. They are unable, however, to withstand extreme desiccation.

"Sheep may be infected with *D. filaria* by feeding final-stage larvæ. The larvæ in all probability travel from the alimentary tract to the lungs by way of the blood stream. The worms attain maturity about 6 weeks from the time of infection. This would seem most probably to be the natural method of infection. Probably infection of cattle with *D. viviparus* takes place in a manner essentially similar to that of sheep with *D. filaria*. Final-stage larvæ of *D. filaria* do not appear to be able to penetrate the unbroken skin."

Physico-chemical considerations in regard to agglutination, infection, and immuunity, A. von Szent-Györgyi (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 30 (1920), No. 2, pp. 144–153*).—The author classifies pathogenic microorganisms into two groups, depending upon whether they remain in suspension in a fluid medium and on growing tend to form a uniform turbidity, or whether they have a tendency to flocculate. The agglutination reaction is strong in the first group and weak in the second. The organisms in the first group are those causing septic and acute forms of disease with subsequent lasting immunity, while those of the second group are concerned with local disease processes and lack of immunity. Among those mentioned as illustrative of the first group are the typhoid and paratyphoid bacilli, *Bacillus avisepticus*, *B. bipolaris septicus*, and *Vibrio choleræ*, and of the latter *B. anthracis*, *B. pestis* and *B. mallei*.

Vaccination of animals with killed bacteria, O. Bujwid (*Centbl. Bakt. [etc.], 1. Abt., Orig., 82 (1918), No. 3–4, pp. 308–311*).—The author reports successful results in the vaccination of white mice against anthrax, swine erysipelas, and fowl cholera with killed bacteria, and also in the vaccination of swine against the first two diseases and fowls against fowl cholera by their respective vaccines standardized through the mouse experiments.

A method is described for determining the number of microorganisms in a given weight of the living culture. As determined in this way 1 mg. of staphylococci contained from 100 to 200 million organisms, and the same weight of typhoid and anthrax bacilli 50 to 100 million and 1 to 10 million, respectively. The minimal lethal dose for white mice was found to be 0.00001 mg. of anthrax culture containing from 4 to 10 organisms, and 0.0000001 mg. of fowl cholera bacilli furnishing from 2 to 4 organisms.

The use of a separator for serum production, G. Bugge (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 46, pp. 543, 544*).—The author recommends the use of a centrifuge for the rapid separation of blood serum for use in immunization work.

The dissemination of anthrax infection through industrial sources, A. Eichhorn and A. L. Edmunds (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 3, pp. 278–288*).—"The drainage water from tanneries handling foreign hides constitutes a source of danger for polluting streams with anthrax infection. In at least two instances in the past five years new anthrax districts have been created by such tanneries in the United States and Canada.

"Either Federal or State authorities should be empowered to compel tannery owners to adopt such means as will prevent the contamination of streams with anthrax infection. The soaking of the hides by either the Seymour-Jones or Schattenfroh methods will effectively control the anthrax infection in hides. These methods, however, are only effective if consistently carried out. If the soaking in disinfectants is not practiced, the elimination of the solid matters from the drainage water should be insisted upon. This may be accomplished by the installation of revolving screens and settling tanks. The effective operation of the screen and settling tanks should be periodically controlled.

"Where no precautions are taken to guard against continuous pollution of the drainage water, and where animals have access to the streams in which such drainage water flows, they should be vaccinated not only in the routine manner but also periodically revaccinated in order to confer upon them the maximum of immunity. Even if the necessary precautions are taken by the tanneries, the animals which have access to the land previously known to have been infected by tanneries should be regularly vaccinated. In case of the development of anthrax in such districts the outbreaks should be controlled by the usual approved sanitary measures."

The control of anthrax in the Canal Zone, W. J. Taylor (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 3, pp. 275–277*).—This is a brief discussion relative to the control of anthrax, which is introduced with animals imported from Colombia for beef.

Cutaneous vaccination against anthrax, A. Besredka (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 18, pp. 769, 770*).—The author states that on rubbing the shaved skin of a guinea pig with anthrax vaccine No. 1 a local inflammatory reaction is produced which lasts from four to six days. Subsequent treatment with the second vaccine causes no irritation. That immunity is acquired is shown by the fact that no reaction follows the subcutaneous inoculation of virus. If the animal is given a cutaneous application of the second vaccine without the first, death always ensues.

Rabbits can also be immunized cutaneously.

The treatment of foot-and-mouth disease with blood and serum, G. Bugge (*Milchw. Zentbl., 49 (1920), No. 21, pp. 290–292*).—This is a reprint with comments of a leaflet of directions issued by the German Ministry of Agriculture on September 4, 1920, for the prophylactic and preventive treatment of foot-and-mouth disease. These directions include the methods of obtaining the immune blood and serum from animals cured of the disease, the dosage for various animals, and methods of inoculation.

For full-grown cattle a dose of from 100 to 400 cc. of blood is recommended, depending on the weight and condition of the animal. Sick animals should be given larger doses than healthy. For calves, sheep, swine, and goats from 50 to 100 cc. is recommended. The dose of serum should generally be about half that of the blood. The author is of the opinion that smaller doses of blood or serum than those recommended above are sufficient.

Attention is called to the necessity of painstaking care in the preparation and use of the vaccine and in selection of suitable animals for the preparation of the blood and serum.

Vaccination with Loeffler's foot-and-mouth disease serum, Himmel (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 46, pp. 541–543*).—Data are given of the losses in the first 24 hours and in the following 14 days after vaccination of cattle, calves, swine, goats, and sheep for foot-and-mouth disease. The much higher percentage loss in the first 24 hours is traced to the severity of the disease in those particular cases. It is recommended that the serum be given as early as possible in the disease.

A new treatment for foot-and-mouth disease by means of nonspecific immunization with "Aolan," THUN (*Berlin. Tierärztl. Wchnschr., 36 (1920), No. 37, p. 432*).—The author claims to have obtained good results in the treatment of foot-and-mouth disease in cattle and swine with a commercial milk protein solution called "Aolan." The treatment consists in the intramuscular injection of various amounts of the material (200 cc. for cattle and 10 or 25 cc. for young pigs). A single injection has in general been found sufficient to produce prompt amelioration of symptoms.

Studies in infectious abortion (*Michigan Sta. Tech. Bul. 49 (1920), pp. 3–30, figs. 4*).—This publication contains the reports of four studies on infectious abortion as follows:

I. *On the presence of Bacterium abortus in the deeper layers of the mucous membrane of the nongravid uteri*, H. J. Stafseth (pp. 3–6).—To throw more light on the question of the persistence of *B. abortus* in the genital tract, the uteri of 6 cows with histories of abortion and from herds badly infected with abortion disease were examined by the author and E. T. Hallman for the presence of the organism by direct cultural studies and animal inoculation. The findings were entirely negative as regards the organism in question. The author concludes that while the cases examined were few in number, the results obtained may be considered as additional evidence that *B. abortus* does not persist indefinitely in the genital tract and does not penetrate into the deeper layers of the mucous membrane and remain there as a latent infection.

II. *A few notes on the isolation and cultivation of B. abortus, with special reference to liver and spleen media*, H. J. Stafseth (pp. 7–11).—The substitution of liver or spleen for the beef of the ordinary beef agar has been found to give a medium in which growth of *B. abortus* is much more rapid than on ordinary beef agar. The spleen medium was further improved by the addition of 1 per cent starch or 1 per cent dextrose, or both, while the liver agar did not require the addition of carbohydrate. The use of an anaerobic jar as a container of the culture tubes was found to be more efficient and convenient than sealing the individual tubes with sealing wax.

III. *On the possibility of differentiating between infected and immune animals in infectious abortion*, H. J. Stafseth (pp. 12–24).—Evidence is presented from guinea pig studies that the intradermal test may be used to detect infection with *B. abortus* in connection with complement fixation and agglutination tests to differentiate between infection and immunity. The abortin used in the laboratory tests consisted of a suspension of living organisms in physiological salt solution as prepared by Reichel and Harkins (E. S. R., 37, p. 276). Nine guinea pigs which had been given intraperitoneal injections of live cultures of *B. abortus* reacted positively to complement fixation, agglutination, and intradermal tests 8, 16, 24, and 32 days after injection. The same number of animals previously injected with a suspension of killed cultures at 5-day intervals developed positive reactions to complement fixation and agglutination tests, but not to the intradermal test. Animals previously infected with *Bacillus typhosus* and *B. tuberculosis* gave negative intradermal tests.

Treatment with dead cultures of *Bacterium abortus*, whether administered before or after infection, did not affect the intradermal reaction nor protect guinea pigs against infection with *B. abortus*. Male animals placed in cages with infected females developed positive reactions to all tests employed, showing that infected guinea pigs must discharge the organism.

It is reported in conclusion that similar intradermal tests on cattle indicate that the test may be employed as a means of detecting animals which harbor

live abortion organisms in their bodies, but that the work on cattle has not progressed sufficiently to warrant any definite conclusion.

IV. *The isolation of B. abortus from milk*, I. F. Huddleson (pp. 25–30).—The medium found most successful for the isolation of *B. abortus* from milk is liver infusion agar in which is incorporated sufficient gentian violet to give the dye a final dilution of 1 : 10,000. The medium is adjusted to an H-ion concentration of between pH=6.6 and 6.4 by the colorimetric method, using bromthymol blue as indicator. The medium should be prepared without excessive heating and filtered through glass wool instead of cotton or paper.

In the work reported, the samples of milk were collected in sterile test tubes after discarding the first milk and about 10 cc. of each sample centrifugalized for 2 hours at 2,000 revolutions per minute. About 0.1 cc. of the sediment was withdrawn from the bottom of each tube by means of a capillary pipette and plated evenly on the solidified gentian violet agar plates. The plates were then incubated for about 4 days in a closed chamber in which 10 per cent of the air had been displaced by CO_2 gas.

The milk tested included samples from each of the four quarters of 12 cows, half of which had never aborted, while the remainder all had histories of abortion. The bacteriological examinations were in each instance controlled by inoculating guinea pigs intra-abdominally with 5 cc. of whole milk from each sample, killing the animal after 8 or 10 weeks, and examining the spleen and liver culturally for the organism.

The milk from the 6 cows which had never aborted gave negative tests with both the methods employed. The tests were negative for one of the other animals and positive in one or more quarters for the other 5, the positive results with both methods agreeing in every case.

The cultural method, which is said to have been employed with success in isolating *B. abortus* from the stomach contents of aborted fetuses and from the fetal membranes and uterine exudate of cows which had aborted, is recommended in preference to the animal-inoculation method, particularly in that it requires only 4 days instead of at least 8 weeks, as in the latter method.

Studies in infectious abortion, I. F. Huddleson (*Jour. Amer. Vet. Med. Assoc., 58 (1921), No. 5, pp. 524–531*).—A brief discussion is given of work at the Michigan Experiment Station on the immunization of nonpregnant cows and heifers against infectious abortion caused by *Bacterium abortus* and on the isolation and cultivation of *B. abortus*, the latter problem being discussed more fully in the publication noted above. In the first study the 3 types of vaccine used, which were administered subcutaneously, were (1) 20 cc. (100 billion) of living abortion bacilli in sterile physiological salt solution; (2) 10 cc. (50 billion) of killed organisms in 0.5 per cent phenol salt solution, followed after 7 days by 20 cc. (100 billion) of living organisms; and (3) 3 doses at 7-day intervals of 5 cc. (10 billion) and 10 cc. (50 billion) of a suspension of killed, and 20 cc. (100 billion) of living bacilli.

Data obtained on 2 herds of cattle with the use of these 3 vaccines, to be presented in detail in a later publication, "apparently indicate a decrease in the abortion and sterility rate of the treated animals and a marked increase in the breeding efficiency of the treated over the untreated animals." It is also noted that the calves born of the treated animals gave negative reactions to the serological tests at birth and have not been affected with white scours or other diseases attributed to *B. abortus*.

Immunization of cattle against contagious abortion, A. Gminder (*Berlin. Tierärztl. Wchnschr., 35 (1919), No. 20, pp. 163–166*).—This is a discussion of

the value of immunization of cattle against contagious abortion, based upon the results obtained with different methods over a period of several years. Data obtained with 1,390 animals in 45 herds are summarized as follows:

Subsequent to the vaccination of 370 pregnant and nonpregnant animals with killed cultures of mixed abortion bacilli, repeated at an interval of from 4 to 8 weeks, 69 abortions occurred. Of 110 pregnant animals vaccinated first with killed bacilli and then with killed bacilli plus immune serum, 20 later aborted. Of 220 nonpregnant animals vaccinated once with living bacilli and allowed to breed 8 weeks later, 15 cases of abortion followed. The vaccination of 81 animals with living abortus cultures plus immune serum in the second or third month of pregnancy was followed by 6 abortions. In all, out of 781 vaccinated animals 110 abortions occurred, while in 609 nonvaccinated controls there were 128 abortions.

In interpreting these results the author emphasizes the greater value at present of the use of living cultures, while pointing out certain disadvantages in the method, such as the possibility of introducing living bacilli into the milk of the treated animals. It is suggested that with certain improvements in the technique of preparing vaccines from killed bacilli, such as the use of older cultures and higher temperatures, better results may be obtained with this method.

The Bang system for reacting cattle at the Lincoln Agricultural School, Lincolndale, N. Y., M. E. Buckley (*N. Y. State Dept. Farms and Markets, Agr. Bul. 128 (1920), pp. 38–42, pl. 1*).—This is a report of a successful experiment in the use of the Bang system of separating tuberculin-reacting cows and using them for breeding purposes, the calves being separated from their mothers immediately after birth and fed on pasteurized milk or fresh milk from nonreacting cows. During the three years in which the experiment ran, 111 head of young stock were raised, none of which reacted positively to the tuberculin test.

It is pointed out that while it is impracticable for most farmers to keep two separate herds, it might be possible to maintain certain farms where the reacting cows could be segregated and the calves returned to their owners under regulated conditions.

Strongylosis (Ostertagia) in cattle, J. E. Ackert and W. E. Muldoon (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 2, pp. 138–146, figs. 5*).—"An outbreak of strongylosis due to *O. ostertagi* occurred at Manhattan Kans., in March, 1920. Forty steers were visibly effected, 12 seriously, and 9 died. The most obvious symptoms were extreme emaciation, anemia, and edema in the submaxillary region, and, in advanced cases, profuse diarrhea.

"The parasites are small, yellowish-white, hair-like nematodes, about one-third of an inch in length. They cause the formation of nodules on the abomasum walls, in which they develop, and which eventually result in erosions of the mucous membrane. The life history is not completely known, but it is probable that infection is direct, the eggs or larvæ gaining entrance in food or water or by the host licking itself. The parasites are bloodsuckers.

"Treatment is difficult and uncertain. All recorded outbreaks due to this parasite have been among calves or yearlings. This report is the first record of such an outbreak in Kansas and the second in the United States. Strongylosis outbreaks due to *O. ostertagi* have been reported from Germany, the United States, England, Argentina, and New Zealand."

Diseases of sheep, B. A. Gallagher (*U. S. Dept. Agr., Farmers' Bul. 1155 (1921), pp. 39, figs. 6*).—This is a popular summary of information on the diseases to which sheep are subject.

Diphtheria bacilli in the horse, F. C. Minett (*Jour. Compar. Path. and Ther., 33 (1920), No. 4, pp. 267–293, figs. 4*).—"Bacilli proved to be identical with human diphtheria bacilli have been isolated from 11 horses and 1 mule, all of which animals, with the exception of 2, presented on the limbs lesions that were described as simulating those of ulcerative lymphangitis. Of the two exceptions, 1 animal showed cutaneous lesions somewhat resembling those of acne, and the other was a case of suppuration of a nasal sinus in which treatment by trephining had been tried without success. Of the 12 strains isolated, 5 proved to be toxic and the remainder exhibited no evidence of toxicity."

Observations regarding pathological conditions in fowls, B. F. Kaupp (*Jour. Compar. Path. and Ther., 33 (1920), No. 4, pp. 294–307, figs. 13*).—This is a report of miscellaneous observations of diseases in fowls made in the past few years at the North Carolina Experiment Station. They relate respectively to hepatitis, nephritis, and splenitis in a duck; the depluming louse of the fowl, *Lipeurus variabilis;* curvature of the spine in young fowls; purulent pericarditis with secondary changes in a fowl; inflammation of the shell gland; weakness of the musculature of the walls of the oviduct of the hen; open joint in a cockerel; arthritis terminating in ostitis of the femoro-tibial point of a cock; exostosis of the hock joint simulating spavin of the horse; tumefied ova in the hen; hæmatoma of the ovary of a hen; and productive inflammation of the soft structures of the shank accompanied by nephritis in a cock.

A study of cloacitis in the domestic fowl (so-called "vent gleet"), S. A. Goldberg and J. P. Benson (*Cornell Vet., 11 (1921), No. 1, pp. 41–52*).—"Vent gleet was not transmitted from a diseased fowl to a healthy fowl when placed in the same coop for 23 days. It was not produced by rubbing diseased tissues into the normal cloaca, the scarified cloaca, or the scarified cloaca treated with acetic acid. Feeding of the diseased tissue to fowls failed to produce the disease.

"The etiology of vent gleet was not determined. It seems possible that the agents employed in the experiments would produce the condition, if the irritation was long continued as occurs under natural environment. Ulcerative cloacitis was accompanied by uremic poisoning in at least four out of nine cases studied.

"The best results in treatment were obtained when there was an ulceration of the proctodæum with dermatitis. A case where ulceration was accompanied by abundant granulation tissue did not yield to treatment.

"The term ulcerative cloacitis should be substituted for the vague term vent gleet because of the confusion of a number of diseases in which the term is used."

The diagnosis, therapeutics, and prophylaxis of chicken pox (contagious epithelioma) of fowls, J. R. Beach (*Jour. Amer. Vet. Med. Assoc., 58 (1920), No. 3, pp. 301–312*).—"As they exist in California, there does not appear to be any etiological relationship between chicken pox and those pathological conditions of the nasal passages commonly designated as colds, roup, or swelled head. Many so-called outbreaks of roup may in reality be a disease manifested by symptoms very similar to roup but due to nutritional factors. There appears to be ample evidence that chicken pox and those pathological conditions of the mucous membranes of the mouth and eyes commonly designated as canker or avian diphtheria are etiologically identical.

"Vaccine prepared from desiccated chicken-pox virus, while not conferring, in the majority of cases, complete protection against severe artificial infection, does not confer a considerable degree of resistance. This is shown by the

mildness of lesions produced by inoculating vaccinated birds with virus as compared with those produced on nonvaccinated control birds.

"Chicken-pox vaccine has proved to have considerable curative value when used on diseased birds. Chicken-pox vaccine has proved a very effective means of promptly checking outbreaks of chicken pox and canker. The use of this product has become very general among poultrymen of California. The length of immunity produced by chicken-pox vaccine may vary from two months to more than two years. For this reason the vaccine is recommended only to check the spread of the disease in flocks already infected.

"The efficiency of chicken-pox vaccine is dependent upon the degree of virulence of the virus contained in it. Since there is considerable variation in the virulence of different lots of virus and there is at present no method of standardizing the virulence of virus, there is necessarily considerable variation in different lots of vaccine. It is realized that the present method of preparing chicken-pox vaccine is very imperfect. Thus far, however, all efforts to devise a better method have proved failures."

RURAL ENGINEERING.

Summary of investigations on effect of tile drains in the lime or prairie section of Alabama, L. A. Jones (*Alabama Col. Sta. Bul. 214* (*1920*), *pp. 97–107, figs. 2*).—This report, prepared under a cooperative agreement between the U. S. Department of Agriculture and the Alabama Experiment Station, describes the methods of securing data and analyzes some of the results obtained in an extensive study of the action of soil water in tiled prairie land and of run-off from such lands.

The object of the studies was to determine the most satisfactory spacing and depth for tile drains. The soil is a typical Houston clay prairie soil. The tile lines were for the most part spaced 75 ft. apart and laid from 3 to 3½ ft. deep. Two lines were spaced 100 ft. apart and laid 4 ft. deep. The fluctuations in ground water level were determined by the use of test wells made of 4-in. draintile.

Dynamiting this soil with one-half-stick charges of 30 per cent dynamite did not appear to improve drainage conditions.

The general elevation of the soil water during the spring months in tiled land was from 2 to 2½ ft. below the ground surface, while that in untiled land was from 1 to 2 ft. below the surface. After heavy rains the soil water in the tiled land was found to return to an average depth of from 2 to 2½ ft. within 2 or 3 days after the storm ceased, but in the untiled land the line of saturation remained within a foot or two of the surface for from 5 to 10 days.

"Tile placed 3 to 3½ ft. deep gives better drainage in the Houston clay or prairie soils than does tile placed 2 to 2½ ft. deep, because it lowers the line of saturation to a greater depth. However, tile lines should never be placed more than 6 in. into the limestone hardpan found underlying the prairie soils, and its distance below the surface should govern the depth of the drains where the hardpan is less than 3 ft. from the surface of the ground.

"Laterals spaced 75 ft. apart and laid 3 to 3½ ft. give satisfactory results in the flat bottom land where the black type of Houston clay is found. The lighter colored phases of the Houston clay do not seem to drain as rapidly as do the black phases, and drains spaced 60 ft. apart and laid 3 ft. deep are believed to be advisable for the lighter types. Drains spaced 40 to 50 ft. apart and placed 2 to 2½ ft. deep did not show more satisfactory results than did those spaced 60 ft. apart and laid 3 ft. deep. The drainage obtained from tile

spaced 100 ft. apart and placed 3½ to 4 ft. deep is not satisfactory, as the action of the drains is too slow."

It was found that during a dry spring or summer the benefits from underdraining flat or bottom lands are greater than from rolling land. The main outlet drains in the systems studied were designed for a capacity of ½ in. of run-off per 24 hours, but the run-off investigations showed that the outlets rarely discharge to capacity for more than 3 or 4 hours at a time and that the discharge decreases rapidly after the rain ceases. "In designing a system of underdrainage in the prairie section it is believed that a run-off coefficient (discharging capacity) of ⅜ in. to ½ in. per 24 hours for the area tiled should be used, the coefficient depending upon the amount of watershed draining onto the tiled area. If there are surface inlets into the tile lines, a coefficient of at least ½ in. should be used. There is nothing in the data collected to show that a coefficient of ¼ in. would not provide satisfactory drainage, but where rainfall is as frequent and as intense as it is in the prairie section during the winter and spring months, it seems advisable to have sufficient outlet capacity."

Test wells placed 10 ft. apart indicated that the soil water curve between tile lines has the greatest slope near the tile, the slope gradually decreasing as the distance from the tile increases. The effect of the drains was not marked at a distance greater than 30 ft.

Agricultural chemical studies of irrigation in Java, L. G. DEN BERGER (*Landbouwscheikundige Onderzoekingen Omtrent de Irrigatie op Java. Delft [The Netherlands]: J. Waltman, jr., 1915, pp. XI+108+4*).—The work of others bearing on the subject is reviewed, and chemical and physical studies of the influence of irrigation with normal irrigation water on the soils of Java are reported.

It was found that a condition of equilibrium exists between soils and irrigation water in regard to absorbable materials, such that part of the dissolved constituents in the water may be fixed by the soil and part of the soil constituents may be dissolved by the water. The compositions of the drainage and surface run-off water were different, which is considered to be due mainly to the carbon dioxid content of the soil. Plant growth and evaporation had little influence on the equilibrium existing between soil and irrigation water.

In connection with the results of these studies a laboratory method of approximating the influence of irrigating a given type of soil with water of predetermined composition is presented. By this method two samples of the soil are extracted with distilled water and with the irrigation water, with and without the injection of carbon dioxid. A comparison of the compositions of the extracts with that of the irrigation water is said to indicate the action of the soil toward the dissolved constituents of the water. Practical applications of this method are described.

The silt in irrigation water was found to improve the physical condition of most of the soils experimented with.

Study of a spray irrigation plant, BESEMFELDER and E. MEYER (*Mitt. Deut. Landw. Gesell., 35 (1920), No. 43, pp. 579–582, figs. 6*).—A spray irrigation plant of German manufacture which is adapted for truck farms and gardens is described in some detail and the mechanical features diagrammatically illustrated.

Effect of alkali water on concrete, B. F. ERDAHL (*Concrete [Detroit], 17 (1920), No. 2, pp. 137, 138*).—A number of studies of the effects of alkali water on concrete are reviewed. Special attention is drawn to analyses of concrete drain-tile in alkali soils, which indicated that a liberation of lime and an absorpton of magnesia and sulphates had taken place. The data suggests a

physical absorption of magnesium sulphate, and to prevent this the waterproofing of surfaces of concrete structures is considered advisable.

How to use slump test for better block, A. J. R. Curtis (*Concrete* [*Detroit*], *17* (*1920*), *No. 2*, *pp. 57, 58, figs. 4*).—Information is given on the proper method of making the slump test of concrete as a means of improving concrete block.

Public Roads (*U. S. Dept. Agr., Public Roads, 3* (*1921*), *Nos. 33, pp. 40, figs. 4; 34, pp. 28, figs. 2*).—These numbers of this periodical contain the following articles:

No. 33.—Shall the State Own and Operate Its Own Portland Cement Plant? by H. E. Hilts; Difficulties Experienced by the States in the Matter of Rail Transportation, by S. E. Bradt; What the Highway Department May Expect in Service in 1921 from the Railroads, by A. G. Gutheim; The Relative Service Value of Different Types of Rural Pavements, by A. R. Hirst; The Analysis and Preparation of Estimates for Road Construction, by H. J. Kuelling; and The Study and Treatment of the Different Subgrades and Foundations, by C. M. Upham.

No. 34.—Researches Affecting the Design of Roads for Heavy Motor Trucks, by A. T. Goldbeck; Load Limitations for Primary and Secondary Roads, by C. J. Bennett; Modification of Contracts to Meet Present Conditions, by W. R. Neel; Organization of a State Road Maintenance Department, by J. N. Mackall; Report of Committee on Use and Care of Federal Equipment; and Federal-aid Allowances—Project Statements Approved and Agreements Executed in December, 1920.

State highway construction in 1920 and 1921 (*Engin. and Contract., 55* (*1921*), *No. 5, pp. 100–106*).—Data on the work and expenditures of 29 different States on road construction and maintenance during 1920 are given, together with estimates for 1921.

Third and fourth biennial reports of the Department of State Lands, Highways, and Improvements for the period ending November 30, 1920 (*Ark. Highway Comm. Bien. Rpts., 3* (*1917–18*), *pp. 1–94; 4* (*1919–20*), *pp. 97–177*).—This report contains, among other things, data on the work and expenditures of the State of Arkansas on highways during the two biennial periods ended November 30, 1920.

Report of the State Highway Board of Missouri for the period ending December 1, 1920 (*Missouri Highway Bd. Bien. Rpt., 1919–20, pp. 249, figs. 47*).—This report presents data on the work and expenditures of the Missouri State Highway Board for the biennial period ended December 1, 1920.

Relative service value of different types of rural pavements, I–III, A. R. Hirst (*Good Roads, n. ser., 20* (*1920*), *Nos. 25, pp. 291, 292, 301; 26, pp. 305, 306, 308, 309; 21* (*1921*), *No. 1, pp. 2–4, 6, 8*).—In this paper, presented at the sixth annual convention of the American Association of State Highway Officials at Washington, D. C., the author deals with the relative service value of different types of rural pavements from the standpoints of cost, economics, and the potential power of a pavement to bear traffic of various amounts, with particular reference to experience in Wisconsin.

It was concluded that service value must always be considered with reference to service cost, and that in making a comparison interest on the successive investments should be included in the gross cost. Soil, climatic, and rainfall conditions have a bearing on service value and should be always reckoned with. Width is an important factor in service, and has a very large bearing on the conduct and maintenance cost of pavements, especially of the inferior types. Proper design and layouts are important, regardless of type,

and poor design and layouts seriously impair the service value of the best types. Traffic has a grave bearing on service, and must be restricted and controlled in advance of construction plans.

States should divide their roads into classes and name the limiting load for each class. It is considered not always possible to build the surface that will give the most economical service on a specific portion of highway. There can be no comparison of service values without assuming proper maintenance of all types of surface. Constant so-called travelability is considered supremely important, especially on main traveled highways, and will often determine the type and width of surface to be used.

Subgrade support in pavement design, C. OLDER (*Engin. News-Rec., 86 (1921), No. 5, pp. 210–212, figs. 4*).—Studies by the Division of Highways of the Illinois Department of Public Works are briefly described, indicating that regardless of the supporting capacity of the subgrade the weak points of rigid slab pavements are the corners formed by the intersection of cracks and joints with each other and with the edges of the pavement.

Further studies showed that capillary seepage destroys the supporting power of subsoils, indicating strongly that it may be difficult if not economically impracticable by any system of drainage, combined possibly with waterproofing of the subgrade, to maintain a clay subgrade dry enough to afford any reliable support to the corners. Methods of design to cover this point are discussed and the tentative slab formula $d=\sqrt{\frac{1.5W}{S}}$ is proposed, in which d is the depth of slab, W is the maximum wheel load, and S is the allowable tensile stress of the material forming the upper surface of the transverse strength element of the slab. This formula assumes that one-half of the maximum wheel load is applied at the corner.

The Illinois experimental highway, C. C. BROWN (*Pub. Works, 50 (1921), No. 6, pp. 115–118, figs. 2*).—A test road being constructed by the Illinois Division of Highways for the purpose of conducting experiments upon concrete and concrete bases with brick and asphaltic wearing surfaces is described.

Experimental reinforced concrete roads in Milwaukee County, H. J. KUELLING (*Concrete [Detroit], 18 (1921), No. 2, pp. 79, 80*).—Experiments begun in 1917 by the Wisconsin Highway Commission on reinforced concrete roads, using plain rod, wire cloth, and rib metal reinforcing, are reported.

It was found that the section which cracked the most was the one with the heaviest reinforcements. It was impossible to distinguish between reinforced and nonreinforced sections as far as cracking was concerned, and it is concluded that reinforcement can not be recognized as a factor in preventing cracks in concrete roads, but only as a means of holding the cracked pieces of the slabs together. As far as cracking in the road is concerned, it is thought that the most of the reinforcement, if not all of it, should be placed across the road. The breaking off of slab corners makes a certain amount of reinforcement along the outside edge of concrete road slabs necessary. These rods should be placed near the top of the slab. It is considered very doubtful whether it is necessary to reinforce more than a fraction of the concrete roads transversely, because where fills are uniformly made there is little chance of cracking, especially on roads under 18 ft. in width.

Corn-belt farmers' experience with motor trucks.—A study of 831 reports from farmers who own motor trucks, H. R. TOLLEY and L. M. CHURCH (*U. S. Dept. Agr. Bul. 931 (1921), pp. 34, figs. 3*).—This bulletin summarizes the experience with motor trucks of 831 grain and live-stock farmers in the corn belt who have motor trucks for use on their farms.

The average size of the farms is 347 acres. Only 14 per cent of the farms are less than 5 miles from market and 20 per cent 15 miles or more, the average distance being 8 miles. A little over one-fourth of these men have changed their markets for at least a part of their produce since purchasing trucks, the average distance to the old market being 7 miles and to the new one 18 miles. Fifty-seven per cent of the men have not reduced the number of their work stock since purchasing trucks; 25 per cent have disposed of 1 or 2 head; and 18 per cent of more than 2 head, the average reduction for all farms being 1.2 head. It is considered apparent that to a large extent the motor truck supplements rather than supplants the horse on the farm.

The rated capacity of the trucks varies from ½ to 2 tons. Seventy-one per cent are rated at 1 ton and only 9 per cent at less than 1 ton. Experience caused 57 per cent of the farmers to select the 1-ton size as best, 25 per cent the 1½-ton size, and 12 per cent the 2-ton size. About one man in four decided that a truck larger than he now owns is better suited to his conditions. Ninety-one per cent of the farmers believed that their trucks will prove profitable investments. The principal advantage of a motor truck is the saving of time, and the principal obstacle to its use is poor roads.

As compared with horses and wagons, it was found that the trucks save about two-thirds of the time required for hauling to and from these farms. The roads on which nearly 95 per cent of the trucks usually traveled are all or part dirt, and on the average there are over eight weeks during the year when the trucks can not be used on account of the condition of the roads. The condition of the roads prevented the use of the trucks with pneumatic tires a little less than seven weeks during the year and of those with solid tires a little over nine weeks.

Twenty-four per cent of the trucks are equipped with pneumatic tires, 27 per cent with solid tires, and 49 per cent with pneumatics in front and solids in the rear. Fifty-eight per cent of the farmers are of the opinion that pneumatics are best, 35 per cent that solids are best, and 7 per cent that pneumatics in front and solids in rear are best.

These farmers have return loads for their trucks about one-third of the time, and the majority still use their horses for some hauling on the road. On more than half of the farms all the hauling in the fields and around the buildings is still done with horses and wagons. About 40 per cent of the farmers did custom work during the year, the average amount received being $132. It is estimated that these trucks travel an average of 2,777 miles and are used 112 days per year.

The average cost of operation, including depreciation, interest on investment, repairs, taxes, fuel, oil, and tires is estimated at 15.2 cts. per mile for the ½ and ¾-ton trucks, 15.2 cts. for the 1-ton, 21.3 cts. for the 1¼ and 1½-ton, and 25.8 cts. for the 2-ton trucks. The average cost of hauling crops, including the driver's time at 50 cts. per hour, was 24 cts. per ton-mile with the ½ and ¾-ton trucks, 24.1 cts. with the 1-ton, 23.3 cts. with the 1¼ and 1½-ton, and 21.5 cts. with the 2-ton trucks. It is stated that about 1 truck in 15 was out of commission more than 5 days, and 1 owner in 40 reported a loss of more than 5 per cent of the time when using his truck.

Half of these farmers own tractors as well as motor trucks, mostly on the larger farms. Only 33 per cent of the men whose farms contain 160 crop acres or less own tractors, while 65 per cent of those with over 320 crop acres own them. The number of work stock kept on farms where both trucks and tractors are owned is only slightly less than the number kept on farms of corresponding size where only trucks are owned.

The trucks were estimated by 78 per cent of the owners to reduce the expense for hired help, the average estimated saving being $209 per year.

What it costs to haul grain by truck, J. C. THORPE (*Power Farming, 30 (1921), No. 1, pp. 12, 13, 20, figs. 2*).—A report is given of the summarized operating data on about 300 farms in hauling small grain from thrashing machines to grain stations by truck and team. The data deal with 1 and 2-ton trucks with respective normal carrying capacities of about 100 and 150 bu. of oats.

It was found that it cost the least per bushel for hauling by the 1-ton truck overloaded from 25 to 75 per cent. Under normal load and operating conditions the data indicate, however, that for hauls up to about 4½ miles team hauling is cheaper than the use of the 1-ton truck. When the haul exceeded 1 mile the advantage was found to be decidedly in favor of the 2-ton truck. It is concluded that the 1-ton truck operated at its normal capacity has no advantage over teams for this kind of work except for long hauls.

Directory and specifications of farm tractors (*Farm Machinery—Farm Power, No. 1518–19 (1921), pp. 14–19*).—This directory lists 278 tractors of 194 different makes.

Directory of motor cultivators (*Farm Machinery—Farm Power, No. 1518–19 (1921), p. 19*).—This directory lists 35 motor cultivators of 31 different makes.

How to repair broken belt pulleys, G. H. RADEBAUGH (*Power Farming, 29 (1920), No. 12, pp. 14–16, figs. 20*).—Information is given on the correct method of applying leather lagging to an iron pulley and of repairing such a pulley in the farm shop when the flange is broken. Each important step is illustrated in detail.

Carbonization of lubricating oils, C. E. WATERS (*U. S. Dept. Com., Bur. Standards Circ. 99 (1920), pp. 44, figs. 5*).—In this report the nature and effects of the deposits formed in internal-combustion engines are discussed. It is shown that the term carbon is incorrect because the deposits consist largely of asphaltic matter. Brief accounts are given of the nature of petroleum oils and of the theories concerning the formation of deposits. The oxidation and cracking of petroleum are discussed in detail.

Carbonization tests which depend upon oxidation and upon cracking are next taken up, giving full descriptions of apparatus and methods The opinion is expressed that there are ample theoretical reasons for believing that both the oxidation and cracking tests give trustworthy indications of the character of lubricating oils, but it is concluded that there is much yet to be learned upon the whole subject of the lubrication of internal-combustion engines.

Marketing of eggs (*Ireland Dept. Agr. and Tech. Instr. Jour., 20 (1920), No. 4, pp. 527–534, figs. 4*).—A memorandum giving specifications for the material used and the construction of three standard egg cases and for packing and shipping conditions, issued by the Department of Agriculture and Technical Instruction for Ireland.

Barn ventilation test at Brandon Experiment Station [Manitoba], L. J. SMITH (*Agr. Engin., 1 (1920), No. 4, pp. 79–81*).—Tests on a cattle barn 50 by 111.5 ft. outside, with concrete walls 22 in. thick and having a dead air space, and with gambrel roof and Shawver bents are reported.

The barn had a cattle capacity of 67 and a cubic space per cow of 700 cu. ft. The Rutherford system of ventilation was used, with three outtake flues and five intake flues of about half the total area of the outtake flues.

The tests were divided into three periods. In the first period, during which all three outtake flues were open, the average ventilation from 6.30 until 10 p. m was 4,590 cu. ft. per hour per cow, which, allowing 120 cu. ft. of air breathed per hour per cow, gave a purity of 97.36 per cent. During this period

the outside temperature fell 13° and the inside temperature 5°. In the second period, during which only two outtake flues were open, the outside temperature fell 10° and the inside temperature 1.5°. The purity of air maintained from 10 p. m. until 5.40 a. m. was 96.9 per cent. In the third period, during which only one outtake flue was open, the inside temperature rose about 3.5°, while the outside temperature fell 1°. The inside temperature was then 43° F. and the outside temperature −23°. The air purity was maintained at 95.4 per cent during this period, which is still above the standard of 95 per cent.

It is noted that the velocity of the outgoing air averaged 711 ft. per minute. The results also showed that closing the outtake flues does not decrease the air movement in proportion to the decrease in outtake flue area.

The importance of heat in the correct ventilation of hog houses, W. B. Clarkson and C. S. Whitnah (*Agr. Engin., 1 (1920), No. 4, pp. 68–70, figs. 3*).—An analysis is presented of the proper relations between heat, light, and ventilation in hog houses. In comparing these factors, nine typical hog houses were used, including (1) a two-story building with overhead storage, (2) a one-story building with a flat pitch gambrel roof and a ceiling extending across from one hip of the roof to the other, (3) a saw-tooth roof type, (4) a one-story gable roof type, (5) a half monitor roof type, (6) a one-story building with a flat pitch gambrel roof with insulating under the rafters, (7) a one-story building with a flat pitch gambrel roof and an inclined ceiling on each side extending from the hip of the roof down to the girders and across between the girders, (8) a full monitor roof type, and (9) a shed roof type.

Data are given showing the relative heat loss from each of these buildings when the windows are placed as in common practice in first-zone construction, and when the construction is suitable for the third zone, but the buildings are subjected to the low temperatures prevailing in the first zone. Under both sets of conditions the total losses were least with types 1, 2, and 7 and greatest with types 8 and 9. The losses were also very much greater under the second set of conditions.

These results are taken to indicate that a proper consideration of heat, ventilation, and correct size and location of windows is necessary to produce a well-balanced hog house, and that everything else being equal the house that has the least cubic space per hog is the warmest on a cold day. Low, flat-roof types apparently have some advantage as regards light, but the disadvantages are that snow and ice gather on flat roof windows and, unless carefully installed, skylights leak. It is also pointed out that the heat loss is greater through a skylight than through a vertical window.

It is concluded that windows in the room of a hog house should be fitted watertight and covered with storm sash equally well installed, to prevent the gathering of frost on the glass and reduce heat losses to a minimum. It is also concluded that in cold climates a properly insulated ceiling over a hog house will reduce condensation and help to maintain a comfortable temperature.

Plans of rural community buildings, W. C. Nason and C. J. Galpin (*U. S. Dept. Agr., Farmers' Bul. 1173 (1921), pp. 40, figs. 61*).—This supplements Department Bulletin 825 (E. S. R., 42, p. 489), and presents floor plans of a number of community buildings now in actual use and successful operation. The communities which have erected the various types of buildings are classified as farming, farming and village, farming and town, and farming and small city communities.

Water supply and sewage disposal for country homes, E. J. McCaustland (*Missouri Univ., Engin. Expt. Sta. Bul. 21 (1920), pp. 36, figs. 10*).—This bulletin is largely a revision of two previous bulletins of the station (E. S. R., 24, p. 418),

Housecleaning made easier, S. J. MacLeod (*U. S. Dept. Agr., Farmers' Bul. 1180 (1921), pp. 31, figs. 6*).—This gives popular information on how to simplify and facilitate the work of housecleaning and at the same time get full service from the materials used in the furnishing and care of the house.

RURAL ECONOMICS AND SOCIOLOGY.

An economic study of farm layout, W. I. Myers (*New York Cornell Sta. Mem., 34 (1920), pp. 389–563, figs. 94*).—The data for this memoir were obtained from annual maps of 53 New York farms on which certain cost accounting investigations have been carried on since 1915 by the department of farm management of the New York State College of Agriculture cooperating with the Office of Farm Management and Farm Economics of the U. S. Department of Agriculture, supplemented by information furnished by farmers and in some cases by the cost accounts themselves. These farms are located in sections of the State representative of the most important types of farming, namely, the fruit and general crops type of western New York, the dairying business as carried on in southern New York, the general farming of the central part of the State, the intensive dairy production found in southeastern New York, and the fruit and truck farming typical of certain parts of the Hudson Valley. The farms were mapped in detail on a uniform scale of 200 ft. to the inch, the kinds of fence carefully recorded, and swamps, streams, ditches, driveways, stone piles, buildings, and other features indicated. The historical developments of the farm layouts with changes in methods of farming and ownership is traced and illustrated.

A study is made of the size and shape of fields as affecting efficiency in labor and economy of fencing. Detailed labor records and special experiments furnish the basis for the conclusions that the oblong shape gives the most efficient use of labor, while the square shape is the most economical of fencing and of land. Since the saving of labor is usually the more important, the oblong shapes are preferred for crop fields of moderate size, although very large crop fields may be square to save fencing and yet be long enough to permit the efficient use of labor.

Distances about the farm and farmstead as well as arrangement of the buildings are discussed. The ideal arrangement is said to be that where half of the land is on each side of the highway with the buildings in the center of the farm. "Data are herein presented showing the amount of each kind of fencing found on these farms, the adaptation of fencing practice to local conditions in different parts of the State, the distribution of fence on farms, the proportion of farm division lines that are fenced, the relation of size of farm to economy of fencing, the amount of land occupied by fences, the proportion of the farm area inclosed by fence, and the farm cost of fence maintenance. . . . The area of land utilized in lanes on the farms studied is given, as well as the average width of lanes with different amounts of stock."

"The amount of land in cropped fields occupied by fences, swampy spots, streams, and other obstructions, and by different classes of crops, on the farms studied, the relation of size of farms to the proportion of the area of cropped fields occupied by obstructions, the classification of pasture land, the relation of size of pastures to economy of fencing, the classification of woodland, and the present use of land in highways and farmsteads" are indicated. Many farm plans are given, illustrating desirable and undesirable features of farm layouts as well as different stages in the actual rearrangements of some as made by owners, and rearrangements of other farms which have been started but are not yet completed. "A complete inventory of the land on these farms

is given, showing the present use of all land. Data are presented comparing the use of land on these farms with that on the average New York farm, and also showing possible increases in the crop area of the farms studied by reclaiming land now unproductive and by utilizing for crops land which is now occupied by pasture or woods but which would be suitable for crop production. If the farms studied may be considered as typical, substantial increases can be made in the crop area of New York farms to meet the prospective needs of an increasing population."

The inclosure of open-field farms, LORD ERNLE (*Jour. Min. Agr. [London], 27 (1920), No. 9, pp. 831–841; 27 (1921), No. 10, pp. 899–911*).—Open-field farms of England in the fourteenth century and later are briefly described, and social and economic aspects of the common field system are considered. The agricultural advantages and the economic necessity of the inclosure of the fields and conversion to pasture are pointed out. The characteristic features of the two main periods of inclosure, 1485–1560 and 1700–1820, are described.

Immigrant farm colonies in southern New Jersey, S. JACOB (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev., 12 (1921), No. 1, pp. 1–22*).—Abstracts of census returns show for 1910 and 1920 farm data for Cumberland County and for Italian-born farmers in settlements near Vineland, N. J. Similar settlements in the vicinity and large corporation-managed farms offering opportunities for agricultural employment to immigrants are described. Numerous agencies working to aid the settlement of immigrants on the land and National and State sources of information are cited.

Moor colonization in the past and in the future (*Die Moorbesiedlung in Vergangenheit und Zukunft. Berlin: Paul Parey, 1920, pp. XV+151, pls. 4, figs. 11*).—This manual of information and suggestions for the colonization of swampy lowland regions is made up of a number of articles, including introduction, by M. Fleischer; Moor Colonization under State Aid in Hannover and Schleswig-Holstein, by B. Jacke; Moor and Heath Colonization in Oldenburg, by Glass; Moor Colonization in East Prussia, by Dau; Moor and Heath Colonization, by Rothberg; The Activities of the Provincial Colonization Societies for Moor Lands, by Röhr; Lowland Colonies in the District of Bersenbruck, by Rothert; Moor Colonization in Bavaria, by Mayer; Large Scale Colonization by State Governments and Industrial Societies, by Tschackert; Colonization of the Randow Region, by G. Steinbrück; The Haviland Swamp, its Improvement and Settlement, by H. Bolckmann; The Colonization of Lowlands, by W. Freckmann; Experience and Preparation of the Settler, by Behncke; The Value of Demonstration Plats for the Colonies, by F. Brüne; The Importance of the Cultivation of Native Pasture on Moor Settlements, by C. A. Weber; Vegetable Gardens and Orchards for Lowland Settlements, by A. J. Werth; Buildings for Moor Colonies, by E. Krüger; and In Regard to the New Regulations for Colonization, by Krahmer.

Graphic illustration of Thünen's theory of intensity, R. KRZYMOWSKI (*Fühling's Landw. Ztg., 69 (1920), No. 11–12, pp. 201–219, figs. 8*).—The author illustrates several phases of the law of diminishing returns and the intensity theory as formulated by J. H. von Thünen in his work entitled The Isolated State in its Agricultural and Economic Relationships, showing the tendency toward increasing intensity of agricultural business and higher net returns within certain limits set by costs of production with higher prices for products. He indicates also the effect of the quality of the soil and of various taxes, duties, and similar expenditures on intensity and net return.

Agrarian agitations since the war in regions where share renting prevails, E. FAINA (*Gior. Ital. Agr., 3 (1920), Nos. 8, p. 1; 9, p. 1; 10, p. 1*).—From figures taken from the books of 11 large holdings representing 306 farms,

index numbers have been worked out on the basis of the average for 1914 and tabulated to show the increase in net return and yields from crops and live stock in the Umbro-Tuscan region of Italy. Other data taken from unpublished proof sheets of agricultural statistics complied by the Italian Ministry of Agriculture are given showing the quantities and values of important crops in 1909 to 1918.

It is pointed out that while the net expendible income of the proprietor increased in 1918 over that of 1919 by 90 per cent, the gain of the tenant in the same time has increased 368 per cent, or more than that of any other class of workers, either intellectual or manual, notwithstanding the agitation and strikes which have prevailed. Factions largely responsible for the agitation are said to be asking for a change from one-half share to two-thirds share rent, also that the proprietor assume all or at least the greater part of the risk of diseases of vineyards, be responsible for all or the greater part of the chemical fertilizers used, instead of for half; carry the risk of live stock losses by death, purchase and maintain efficient modern tools and machinery, allow the tenant to maintain poultry and other live stock for his own use without requiring compensation from him for possible injury to crops, and that he pay at least half of the extra labor expense of periods of harvesting. The author urges contracts intended to encourage increased production, and thereby benefit both landlord and tenant.

General economic situation in France, C. G. SAENZ DE ZUMARÁN (*Bol. Min. Agr. [Argentina], 25 (1920), No. 3, pp. 263–374, figs. 38*).—Account is given of price conditions as the author found them on a recent visit to France, also of agricultural industries, particularly the manufacture of cheese and other dairy products. Possible markets in France for frozen beef and other meat products and of breeding animals from Argentina are discussed.

Report of farm improvement in Friesland, C. K. DILLING (*Ontginning en Grondverbetering in Friesland. Arnhem: Nederland, Heidemaatschappij [1920], pp. 85, pls. 2, figs. 24*).—This is a general report on the agricultural population, agricultural methods, forestation of waste lands, drainage, products, and development of transportation facilities on the mainland and in the islands of Ameland and Schiermonnikoog.

Bulgarian agriculture now and in the future, A. DIX (*Landw. Jahrb., 50 (1916), No. 5, pp. 833–861*).—Brief historical and geographical notes as to prewar conditions are given.

The essentially rural character of the population of the country and particularly the tendency of the native Bulgarian element to remain on the land is indicated. According to statistics given relating to land holding and land utilization, 25 per cent of the land belonged in 1908 to municipalities and 48 per cent was the property of individuals. The latter is said to have been excessively subdivided into small holdings. The area devoted to orchards and mulberry gardens had increased 83.9 per cent since 1897, and that in rose fields 62.3 per cent. Vineyards had decreased 17.3 per cent and pasture and forests had fallen off slightly in area.

Statistical comparison is made of the agricultural exports, the utilization of agricultural machinery, numbers and prices of live stock, the forest industry, fisheries, and cooperative and agricultural aid and credit societies, mainly between the years 1900 and 1910 or 1912. It is said that about 29 per cent of the members of the agricultural savings and loan banks were unable to write. It is suggested that with general education and special agricultural training for the native population, the modernizing of methods, and the development of agricultural credit, this region might be developed as a source of supply of raw material and a market for German industrial products.

Number of farms by States and counties, 1920, 1910, and 1900 (*Bur. of the Census [U. S.], 14. Census, 1920, Agr., pp. 29*).—This bulletin shows 1920 figures subject to correction. The estimate of the total number of farms in the United States in 1920 is 6,449,998. The percentage of increase for the United States as a whole since the last census is 1.4, as compared with a 10.9 per cent increase between 1900 and 1910. New York and Illinois return the largest decrease in the number of farms, while Montana shows the largest increase, 119 per cent.

The rural situation in the South and its needs, A. P. BOURLAND (*Washington: Conf. for Ed. in South, 1914, pp. 11, figs. 21*).—Comparisons of the rural situation in the grain belt and in the cotton belt as regards farm ownership, tenancy, school and church conditions, etc., are made on the basis of numerous surveys. Graphic illustrations are given of the proportions of black and white farmers and of owners and tenants in the population of each section, of church strength, school facts, shifting of the farm tenants, and migration to the towns. General recommendations are made as to community organization.

Farm and home survey, A. W. NOLAN (*Ill. Bd. Vocat. Ed. Bul. 17 (1920), pp. 13*).—The author presents a questionnaire covering the crops and live stock, waste land, fertilizers and farm equipment used on the farm, the surroundings and equipment of the farm home, the size of the family, and educational facilities, social opportunities, health conditions, and religious life. In a foreword to teachers of vocational agriculture, it is suggested that this would make a good class project and would be of value to the rural leadership of the community.

The community center, L. J. HANIFAN (*Boston: Silver, Burdette & Co., 1920, pp. IX+214*).—This book is one of the Teacher Training Series edited by W. W. Charters. It undertakes to present problems of rural social life and recreation and to make suggestions as to how the school, particularly of the small one room, one or two teacher type, may be made to serve as a community center. Special school programs and entertainments and country life programs are outlined. A bibliography of 65 titles is given.

Farm labor v. school attendance, G. FOLKS (*Natl. Child Labor Com. Pamphlet 300 (1920), pp. 18*).—The keynote of the facts presented in this bulletin is that rural child labor must answer for the sin of interference with school attendance and retardation among rural children. Census figures for 1910 are given to show that many rural sections in spite of a small foreign population have a very large percentage of illiteracy, and that in the same regions there is a large amount of child labor. In the course of four years' investigation by the National Child Labor Committee, studies have been made in North Carolina and Kentucky, tobacco growing States; Colorado and Michigan, leading in sugar beet production; Alabama and Oklahoma, two of the largest cotton producing States; and Maryland, leading in strawberry production. Six hundred and seventy schools were visited in representative counties, and school attendance data for 37,837 children were gathered. Other data on school attendance are included in this report from reports of the U. S. Bureau of Education and numerous State authorities.

From the studies of the Child Labor Committee in various regions in regard to retardation, it is noted that the percentage steadily increases as the child becomes of an age to work on the farm, rising in the case of farm workers from 29.2 per cent among 9-year-olds to 86.9 per cent among 15-year-olds, and from 18.1 per cent to 70 per cent among all others. In States where information was secured in regard to promotion it was found that there were 10 per cent more failures among farm workers than among all other absentees.

Home tenure of the child was ascertained in Oklahoma, North Carolina, and Alabama, excluding migrants, for 13,069 children, of whom 5,410 were from tenants' families. It was found that among tenants' children farm workers missed 39.1 per cent of the school term as compared with 31.3 per cent for the farm workers of owners' families; and that they missed on an average 42.9 days as compared with 34.5 days for owners' children. For the entire tenants' children group, an average of 40 days (35.7 per cent of the term) was missed as compared with 29 days (25.8 per cent of the term) for owners' children. Conditions for children of migrant agricultural workers are said to be even worse. A stronger realization of the economic value of education is said to be needed. The enforcement of compulsory attendance laws and reorganization of the rural schools to meet social and economic demands of rural life are urged.

Report of the committee on women in agriculture in Scotland, A. DOUGLAS ET AL. (*Scot. Bd. Agr., Rpt. Com. on Women in Agr., 1920, pp. 115; rev. in Wages Bd. Gaz., 3 (1921), No. 58, pp. 20–22*).—From the inquiry carried on by this committee of the Board of Agriculture for Scotland, it is concluded that education and housing are the most urgent of all the conditions investigated, and that especially more technical education is needed. It is recommended that census figures should hereafter be included under three headings in reporting on women employed in agriculture, namely, women and girls employed whole time, those engaged part time, classified according to occupation, and those not occupied in agriculture, but who are wives or dependents of men so engaged. Other suggestions with regard to health and housing provisions, conferences on wages, and conditions of work are made. The recommendations in regard to education are presented in considerable detail. In appendixes are given extracts from evidence heard by the committee and other technical features of the investigation.

The Farmers' Union, C. B. FISHER (*Ky. Univ. Pubs. Econ. and Sociol., 1 (1920), No. 2, pp. 81, figs. 5*).—This publication is the second of a series of studies in economics and sociology from the University of Kentucky.

A compilation is made of parts of reports and minutes of meetings in order to survey the origin and development of the Farmers' Educational and Cooperative Union of America from 1902 to 1920. Also the principles held by the union in regard to cooperative selling, buying, manufacturing, and insurance, and activities of the State unions in these fields are outlined.

In discussing the legislative program of the Farmers' Union, the author takes the attitude that, everything considered, recognition is due for its wholesome and constructive stand on public questions. Certain proposals formulated by the national convention of 1919 are deemed inconsistent, and it is suggested that mistakes have been made in favor of radical policies or in claiming undue credit for progress. The opportunity of this organization is said to lie in combating tendencies toward class agitation and in working out rural problems in the spirit of nationalism.

Appendix "A" gives a brief account of the National Board of Farm Organizations. Appendix "B" gives the constitution and by-laws of the Farmers' Union, as revised and adopted in 1919, and a bibliography of twenty titles.

Marketing, its problems and methods, C. S. DUNCAN (*New York and London: D. Appleton & Co., 1920, pp. XV+500, figs. 16*).—A school and college textbook covering the general problems and methods of marketing in a broad general survey is presented here. The author states in the introduction that the functionalized processes or systems involved in distribution, institutions to which they have given rise, and the commodity itself may singly, but better

in combination, be regarded as the key to correct analysis of commercial problems.

Part I deals with raw materials and foodstuffs in chapters on analysis of the commodity, analysis of the market, trade organization, the middleman, transportation, organized exchanges, the warehouse, commercial grading of commodities, trade information, market price, and financing distribution. Part II deals with manufactured products.

Marketing farm products in Maryland, F. B. Bomberger (*Md. Univ. Ext. Bul. 22 (1920), pp. 57*).—In this bulletin certain principles to be observed in any system of marketing and distribution of farm products are set forth, together with a summary of the progress of cooperative marketing in the State of Maryland. Appendix A gives a survey of methods of marketing perishable farm products of Maryland, reporting results of some general studies made by P. F. Brookers, cooperating with the Bureau of Markets, U. S. Department of Agriculture, in surveying the marketing of perishable products produced in the State. Appendix B gives a report on the marketing and distribution of home-grown fruits and vegetables in Baltimore, Md., the investigations having been made by T. B. Thompson during the summer of 1919, under cooperative agreement between the Maryland State College of Agriculture and the Bureau of Markets. Suggestions drawn up in the Bureau for a State cooperative law designed to conform to section 6 of the Clayton Act are given in Appendix C.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 3 (1921), Nos. 7, pp. 97–112, figs. 4; 8, pp. 113–128, figs. 2; 9, pp. 129–144, figs. 1; 10, pp. 145–160, figs. 2*).—The usual weekly and monthly summaries, brief articles on domestic movement, imports and exports, prices, and the situation in the market of specified commodities and important classes of agricultural products, together with analyses of foreign market conditions, are given in these numbers. A special article in No. 7 gives a detailed examination of hog prices in the last 11 years, illustrated with charts. In No. 9 the world's butter trade since 1913 is briefly reviewed. In a special article in No. 10, proposed standard grades for lettuce are recommended.

[Agriculture and live stock in Sweden] (*Sveriges Off. Statis., Jordbr. och Boskapsskötsel, 1916, pp. VIII+159, 1917; pp. VIII+153; 1918, pp. VIII+149*).—These annual reports continue information previously noted (E. S. R., 41, p. 594).

AGRICULTURAL EDUCATION.

Report of progress of the subcommittee on college instruction in agriculture, A. C. True, D. J. Crosby et al. (*U. S. Bur. Ed., Higher Ed. Circ. 21 (1920), pp. 11*).—This is the report of a subcommittee on college instruction in agriculture of the U. S. Bureau of Education's advisory committee on agricultural education, dealing with problems of the four-year curriculum for agricultural students as revealed by visits to 20 of the agricultural colleges.

A statement, which was generally accepted by the colleges, is given of the general aim of the agricultural college and of the particular objectives of the individual college. With reference to the two theories as regards the precedence of the fundamental sciences or of the agricultural subjects in the agricultural college course, a practical compromise has been reached, and in most colleges during the first two years courses in several of the sciences run parallel with those in agriculture. The larger number of the colleges visited are committed to the proposition that during the first two years college students should be required to take general basic courses, which should include what the general farmer needs to know in order to carry forward his work intelligently

and successfully. There was, however, a less general agreement as to the organization of basic courses and the time to be devoted to them. Those in charge of teacher-training work in the agricultural colleges are quite generally agreed that basic courses in agriculture, animal husbandry, rural engineering, and rural economics are essential to the best results in their fields. The plan now generally followed is that of having basic courses extending through two years in each of a considerable number of departments.

A great variety of arrangements as regards required and group courses and free electives is found in the curricula of the colleges, but in the main students are considerably limited in the choice of their studies. There is also a general tendency toward a group elective system, under which the student is required to decide on his major subject at a certain period in his course, generally at the beginning of the junior year, if the college curriculum is based on standard entrance requirements of at least 14 units.

Considerable difference of opinion as to whether professional courses for training teachers should be given as undergraduate work was apparent. Practically, however, it is deemed necessary at present that this should be done to fit teachers of agriculture for the Smith-Hughes and other secondary schools. In order that such teachers, as well as students intending to become extension workers or agricultural journalists, be well grounded in the theory and practice of agriculture as taught in the colleges, it is necessary for them to take a relatively large amount of agriculture during their undergraduate course, thus leaving them an opportunity for only a limited training in pedagogical subjects unless they pursue postgraduate studies. The committee hopes that the time will come when a doctor's degree will be a prerequisite to permanent employment on the experiment station staff.

In order to better prepare agricultural graduates to meet the conditions they will find on the farm and in the rural community when they enter upon their active careers the committee has raised the question of the desirability and the practicability of giving the student during his senior year an advanced general course in which the effort would be to present the production, economic, and social problems of agriculture as a connected whole, and have the student consider how what he had learned in his previous studies could be brought to bear on these problems. It was found that in most of the colleges visited little, if any, attention had been given to this problem.

The committee believes that the college curriculum in agriculture should be broadened by more amply or comprehensively organizing and specializing subjects included in rural economics and sociology; also that there should be in the organization of these colleges a general officer subordinate to the dean, who would act as supervisor of teaching and be of coordinate rank with the directors of the experiment station and extension work. A few institutions have already moved in this direction, in some instances by giving the head of some department general advisory or supervisory duties with reference to the general problems of teaching.

[Agricultural instruction at the College of Agriculture, University of the Philippines] (*Philippine Agr., 9 (1920), No. 1-2, pp. 5-16, 25-34, 41-53, pls. 28, figs. 3*).—This number is devoted largely to a description of the instruction and practical work at this institution, including articles dealing with practical work on the college farm, by I. Elayda; instruction in practical plant breeding, by N. B. Mendiola; the sugar chemistry course, by M. L. Roxas; the course in farm accounting, by E. D. Hester; practical work in animal husbandry, by B. M. Gonzalez; graduates of the college, by C. F. Baker; and facts and views of the college and its activities.

Report of the work of the Ultuna Agricultural Institute, Agricultural School and Farm, 1919, J. A. Sjöström et al. (*Red. Ultuna Landtbr. Inst. [Sweden], 1919, pp. [2]+120, pl. 1, fig. 1*).—A report on the organization, instruction, experimental work, and finances of the institute, school, and farm in 1919.

The reorganization of the agricultural schools, Bünger (*Deut. Landw. Presse, 47 (1920), Nos. 86, pp. 591, 592; 87, p. 598*).—This is a discussion of the present deficiencies and of the reorganization of the agricultural schools (Landwirtschaftsschulen) in Germany.

Agricultural research and education, A. M. Laughton (*Victorian Yearbook, 39 (1918–19), pp. 417–422*).—A summarized statement of the present facilities for agricultural research and education in Victoria.

The school of forestry, J. W. Toumey (*Yale Forest School News, 9 (1921), No. 1, pp. 4–6*).—This is a statement of the major facts in the progress of the Yale forest school during the past 10 years as an institution for teaching, research, publication, and public service.

Higher forestry education for the Empire, E. P. Stebbing (*Nature [London], 106 (1920), No. 2666, pp. 438–440*).—This is a discussion of the advisability of training the forest probationers for the Indian forest service entirely in India, or of reverting to the one center for such training in England which was given up when the forestry branch at Cooper's Hill was closed in 1905. This question has arisen in view of the changes to be introduced in the administration of India, under which a larger proportion of the natives will enter the Indian forest service in the future. At present the three universities of Oxford, Cambridge, and Edinburgh are recognized as qualified to train Indian and colonial probationers.

The beginnings of forestry instruction in Prussia, K. Dickel (*Ztschr. Forst u. Jagdw., 48 (1916), Nos. 1, pp. 12–30; 2, pp. 49–72; 3, pp. 107–134; 4, pp. 181–204; 5, pp. 225–254; 6, pp. 313–337*).—This is a discussion of forestry instruction in Prussia, based largely on official documents, in the eighteenth century beginning with the instruction by H. D. v. Zanthier in the forests of Wernigerode in 1766. Brief biographical sketches of leading instructors in this subject are included.

Home economics in college and university, D. Snedden (*School and Soc., 13 (1921), No. 316, pp. 71–73*).—In the opinion of the author, the tendency of home-economics workers to invade the fields of the extrahome world need occasion little trouble if the objectives and methods of training in utilization are sharply and soundly differentiated from those of training for production. Vocational home economics in the university should be organized as a school or college, and should embrace a group of technological subjects that are taken by properly qualified students either for research or in preparation for clearly defined fields of vocational service.

"The vocational objectives of college grade home economics are not, or should not be, vocational homemaking. . . . A liberal-arts college having many women students might, of course, make provision for their training in homemaking, if it seemed expedient, but the simple technical and practical courses sufficient for this purpose would manifestly be of secondary rather than collegiate grade." When the liberal-arts colleges shall have possessed themselves of valid objectives, "their curricula will undoubtedly include courses designed to explain, as well as to advance, the place of the home and all its vital adjuncts in modern society." Such courses would probably belong more appropriately under the social sciences than under technical home economics. Men, no less than women, would thus study the social significance of the home and

good homemaking. They should not have to go to the home-economics college for a course in "cultural" home life.

Consolidated rural schools and the motor truck (*Firestone Tire Co., Ship by Truck Bur. Bul. 6 (1920), pp. 52, figs. 32*).—This bulletin contains a brief history of the consolidation movement, a survey on consolidation by States, a description of a typical consolidated school, results of consolidation, transportation, advantages of motor transportation, and a bibliography. The information is based on visits to some 40 or 50 consolidated schools in 13 States.

Vocational education, S. DOWELL and J. B. HOBDY (*Ala. Dept. Ed. Ann. Rpt., 1919, pp. 93–107*).—This is a report on the progress of vocational education under the Smith-Hughes Act in Alabama for the year ended September 30, 1919.

Vocational education, W. F. DOUGHTY (*Tex. Supt. Pub. Instr. Bien. Rpt., 21 (1916–1918), pp. 203–262*).—This article contains a brief history of Federal grants for educational purposes, the text of the Smith-Hughes Act and of the Texas act accepting it, State plans for vocational education in Texas, and a report on the progress of vocational education in Texas for the biennial period ended August 31, 1918.

Practical arts, E. W. BUTTERFIELD (*N. H. Dept. Pub. Instr. [Bien.] Rpt., (1916–1918), pp. 189–202*).—This is a report on the progress, for the biennial period ended August 31, 1918, of school home garden activities, instruction in agriculture, the mechanic and domestic arts, and the State Board for Vocational Education in New Hampshire.

The status of social and economic studies in rural vocational high schools, D. SANDERSON (*Fed. Bd. Vocat. Ed., Vocat. Summary, 3 (1920), No. 8, pp. 120–122*).—The author submits the results of an inquiry into the status of instruction in rural sociology and economics in vocational high schools, based on replies received to a questionnaire sent to each State supervisor of agriculture and of home economics.

It was found that civics is required or usually taught in 17 States out of the 40 reporting, mostly for one semester in the last half of the senior year. In 13 States it is taught in the third or fourth year (probably elementary civil government), and in 9 in the first or second year (probably community civics).

In 20 States rural sociology is given some attention, mostly as an elective but in several cases combined with other subjects, usually rural economy. In five States it is either required or usually given, and five others expect to introduce work in this field during the coming year.

Some work in rural economy is given in 22 States, and in 12 it is either required or usually given. In 7 the course is one of farm management and rural economy, and there seems to be a tendency to make such a combination. Both rural sociology and rural economy are usually given in the fourth year.

Courses in country-life problems are given only in Wisconsin and California, although considered in other States in courses of rural sociology or rural economy. Of replies received from 35 States, 27 favor a course in community civics, 28 in rural sociology, and 29 in rural economics in 4-year vocational curricula. Six favor giving a year's work to include all these subjects.

Some advocates of the project method in vocational education feel that these subjects might be taught as far as necessary for secondary schools in connection with the project work or in purely vocational courses. Replies indicate that so far as practicable the incidental consideration of such problems as marketing, better roads, conservation, and farm labor in courses in agronomy, dairying, fruit growing, farm management, etc., and of such topics as child labor, infant welfare, recreation, farm labor for women, the family, etc. in home economics courses, is encouraged, but that only where there are capable teachers broadly

trained is much being done with them, as no suggestions are given in the texts or syllabi. Marketing, farm labor and roads, and infant welfare are the topics more commonly considered. Ten States out of 28 replying were unfavorable to a tendency toward the consideration of such economic and social problems in these technical courses, 10 felt that such a tendency was apparent and were favorable to it, and 6 desired these subjects taught as separate courses.

As to whether under existing conditions of the small high school with a few teachers, social and economic problems will be taught best by the agricultural or home economics teacher or by the teacher of history, English, or other academic subjects, the replies from 30 States favor the vocational teacher. Ten States favor either the vocational or academic teacher, preferably the one best trained for such work.

The home project.—Its use in teaching vocational agriculture, A. K. Getman, A. P. Williams, and W. J. Weaver (*N. Y. State Univ. Bul. 712 (1920), pp. 34*).—The authors outline a plan for the organization of home project work for vocational agricultural schools and departments.

Nature study and agriculture, C. C. Schmidt (*Boston: D. C. Heath & Co., 1920, pp. VIII+459, figs. 432*).—The five parts of this book deal respectively with plants; insects; poultry and wild birds; domestic and wild animals; and farm work and the age of machinery, farm management, and boys' and girls' clubs. Practical exercises and projects, a list of books, pamphlets, and periodicals for reference, and lists of birds of the North are included. No attempt, it is stated, has been made to draw an arbitrary dividing line between nature study and agriculture, the former being viewed from the standpoint of the practical and the actual. The aim has been to treat chiefly the topics whose study may yield knowledge of economic value.

Dietetics for high schools, F. Willard and L. H. Gillett (*New York: Macmillan Co., 1920, pp. XX+201, figs. 23*).—This book deals with the dependence of the body on the adaptation of foods to body needs, the applications of the principles of nutrition to the feeding of the family, with special emphasis on the relative values of different foods and economy in buying, and the importance of good food habits. Practical exercises and references to literature are included.

Extension work across the country, R. H. Wheeler (*Cornell Countryman, 18 (1921), No. 4, pp. 187–189, fig. 1*).—Attention is called to the distinctive characteristics of State extension organization in New York, Wisconsin, Minnesota, North Dakota, Montana, Nebraska, Iowa, Missouri, and Illinois. It is stated that New York and Wisconsin represent a decentralized organization with the extension specialists in subject matter departments, while Iowa and Minnesota present a very much centralized type of organization. In Iowa and Illinois the county work is completely organized. The author believes that the trend of organization in these middle Western States is toward the New York and Wisconsin plan.

MISCELLANEOUS.

Thirty-second Annual Report of Illinois Station, 1919 (*Illinois Sta. Rpt. 1919, pp. 20*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1919, brief notes as to the principal lines of work, and a list of publications of the year. The experimental work of the department of horticulture is abstracted on pages 836 and 839 of this issue.

Report of Oregon Station, 1919–1920 (*Oregon Sta. Rpt. 1919–20, pp. 80*).—This contains the organization list and a report of the director for the biennium ended June 30, 1920, including synopses of departmental reports and notes on the substations. The experimental work not previously reported is for the most part abstracted elsewhere in this issue.

NOTES.

Idaho Station.—J. M. Raeder, instructor in botany and assistant plant pathologist of the Iowa College and Station, has been appointed assistant plant pathologist, effective July 1.

Minnesota University.—Frank W. Lathrop has been appointed assistant professor of agricultural education, beginning September 15.

North Dakota Station.—Ralph F. Beard, cereal chemist, has resigned, effective July 1, to carry on graduate work, beginning at the University of Minnesota. A. C. Kuenning, county agent of Dickey County, has been appointed superintendent of the Williston Substation. Charles H. Ruzicka, formerly superintendent of this substation, is acting as superintendent of the college farm.

Ohio Station.—*Breeders' Gazette* notes that Grace Darling Hengerveld, a 9-year old Holstein-Friesian cow owned by the station, has thus far given birth to five sets of twins and two singles, making a total of twelve calves in 7 years.

Vermont University.—A bill has been passed by the legislature appropriating $25,000, annually, for the colleges of arts and science, agriculture, and engineering of the university for a period of two years.

Washington College and Station.—An appropriation of $68,000 was made by the legislature at the session recently closed for replacing the college farm buildings destroyed by the tornado in July, 1920. A modern poultry plant with an incubation cellar, a practice brooding house, a breeding house, and laying houses will be constructed. A new cattle and sheep barn will be built, and the quarters for the dairy herd enlarged and improved.

George A. Olson, head of the station division of chemistry and State chemist, has resigned to become agricultural adviser for the Gypsum Industries Association, with headquarters at Chicago, Ill. J. H. Longwell, instructor in animal husbandry, has resigned to accept a similar position at the University of West Virginia, beginning August 1, and will be succeeded by Richard T. Smith, a 1918 graduate of the college. H. P. Singleton, assistant in farm crops, has been assigned permanently to the Irrigation Substation at Prosser for investigational work in crop production under irrigation.

Agricultural Education in Canada.—At the Ontario Agricultural College a new dairy building and a Memorial Hall, the latter to be erected by private subscription, are to be erected in the near future. The Ontario Veterinary College is to be transferred from Toronto to Guelph, and plans have been provided for a new building to cost $200,000.

The department of biology at Macdonald College has been divided, Professor William Lochhead retaining charge of the department of entomology and zoology, and B. T. Dickson becoming head of the department of botany. Dr. G. P. McRostie has been appointed assistant professor of cereal husbandry, and Walter Biffen lecturer in botany.

Angus A. MacMillan, associate professor of animal husbandry at the Manitoba Agricultural College, has been appointed chief of the sheep and goat division of the Canadian Department of Agriculture. Dr. F. C. Craighead of the Bureau of Entomology, U. S. Department of Agriculture, has been appointed entomologist in the division of forest insects. Dr. A. E. Cameron has resigned

from the entomological branch to become professor of zoology of the University of Saskatchewan.

An act has been passed by the legislature of Quebec establishing intermediate agricultural schools in the principal agricultural centers of the Province. The schools will be placed in the hands of the religious authorities, but the Government will reserve the right to direct the course of study.

University of the Philippines.—The new laboratory building of the college of veterinary science and medicine has been completed, affording quarters for a bacteriological laboratory, classrooms, and offices.

Dr. Guy Potter Benton, formerly president of the University of Vermont, has been appointed president of the university. H. E. Woodworth, a county horticultural commissioner of California, has been appointed professor of entomology in the college of agriculture.

American Food Research Institute.—This institute, established as previously noted (E. S. R., 44, p. 399) by the Carnegie Corporation and Stanford University with Dr. C. L. Alsberg as one of its three directors, has appointed as the additional directors Dr. Alonzo E. Taylor, professor of physiological chemistry of the University of Pennsylvania, and Joseph S. Davies, assistant professor of economics at Harvard University. These three directors are empowered to determine the scientific policies of the institute and the problems to be studied.

The advisory committee appointed by the Stanford University consists of Secretary of Commerce Herbert Hoover; Julius M. Barnes, formerly president of the U. S. Grain Corporation; Dr. J. C. Merriam, president of the Carnegie Institution of Washington; J. R. Howard, president of the American Farm Bureau Federation; President W. M. Jardine of the Kansas College; and George Roeding, chairman of the Horticultural Commission of the State of California.

Thompson Institute for Plant Research.—Dr. William Crocker, associate professor of botany in the University of Chicago, has been appointed director of the newly established Thompson Institute for Plant Research. This Institute, located at Yonkers, N. Y., is expected to begin work this fall. Its management is to be under a board of trustees composed of three business men and three scientists. Dr. John M. Coulter of the University of Chicago and Raymond F. Bacon of the Mellon Institute have been selected as two members of the scientific group and are to choose the third member.

Gypsum Industries Fellowships.—*Breeders' Gazette* announces that fellowships have been established by the Gypsum Industries Association in the Iowa and North Carolina Colleges and in Chicago and Cornell Universities, to study the value of gypsum as a plant food and manure preservative. The value of gypsum on leguminous crops is being tested at present.

Honors Paid by International Institute of Agriculture to David Lubin.—A marble bust of the late David Lubin of California was unveiled by the King of Italy at the Institute building in Rome, March 24. The impressive exercises commemorating Mr. Lubin's services in the founding and development of the Institute were attended by many high Italian officials, the U. S. Ambassador, members of the permanent committee of the Institute, and others. Following an address by M. Edoarda Pantano, president of the Institute, and the unveiling of the bust, Dean T. F. Hunt, delegate of the United States, concluded the exercises with a brief speech of appreciation.

Under previous action of the general assembly of the Institute, the seat occupied by Mr. Lubin is to remain in the assembly room forever unoccupied, and an inscription commemorating his work is to be placed in the Institute building.

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Note.—The abbreviations "Ala.College," "Conn.State," "Mass.," etc., after entries refer to the publications of the respective State experiment stations; "Alaska," "Guam," "Hawaii," "Porto Rico," and "V. I." to those of the experiment stations in Alaska, Guam, Hawaii, Porto Rico, and Virgin Islands; "Can.," to those of the experiment stations in Canada; and "U.S.D.A." to those of this Department.

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